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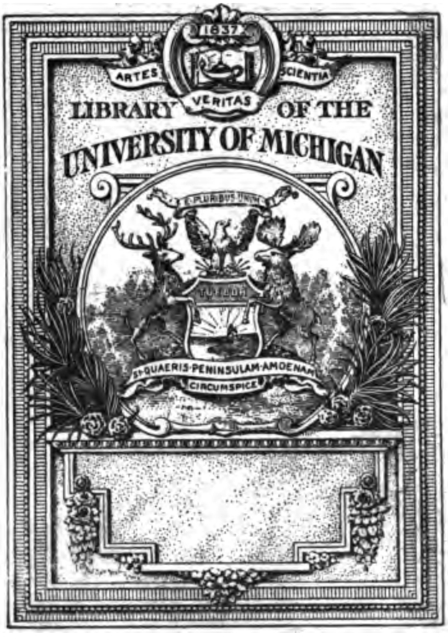
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B. F. WYMAN, PRESIDENT.

Tenth Annual Report

OF THE

ILLINOIS FARMERS' INSTITUTE

WITH REPORT OF

County Farmers' Institutes

AND

AFFILIATED DOMESTIC SCIENCE ASSOCIATIONS

FOR THE

Year Ending June 30, 1905

SPRINGFIELD:
Illinois State Journal Co., State Printers
1905

LETTER OF TRANSMITTAL.

To His Excellency, CHARLES S. DENEEN, *Governor of Illinois:*

SIR—I have the honor to transmit herewith the Tenth Annual Report of the Illinois Farmers' Institute for the fiscal year ending June 30, 1905.

Respectfully submitted,
FRANK H. HALL,
Superintendent-Secretary.

192593

ILLINOIS FARMERS' INSTITUTE.

OFFICERS, 1904-5.

President, B. F. Wyman	Sycamore
Vice President, E. W. Burroughs	Edwardsville
Superintendent of Institutes, Frank H. Hall	Aurora
Secretary, A. B. Hostetter	Springfield
Treasurer, A. P. Grout	Winchester
Auditor, Frank I. Mann	Gilman

BOARD OF DIRECTORS.

Ex-Officio.

Superintendent of Public Instruction, Alfred Bayliss, Springfield.
Dean of the College of Agriculture, Eugene Davenport, Urbana.
President State Board of Agriculture, James K. Dickirson, Lawrenceville.
President State Horticultural Society, H. A. Aldrich, Neoga.
President State Dairymen's Association, Joseph Newman, Elgin.

ELECTIVE BY CONGRESSIONAL DISTRICTS.

1st Dist.—C. P. Reynolds, Drovers' Journal, Chicago.
2d Dist.—B. R. Pierce, 562 45th st., Chicago.
3d Dist.—M. K. Sweet, Glenwood.
4th Dist.—W. Malcom Manley, 828 W. 43d st., Chicago.
5th Dist.—......................................
6th Dist.—F. C. Rossiter, 91 Washington st., Chicago.
7th Dist.—James Frake, 132 LaSalle st., Chicago.
8th Dist.—John M. Clark, 143 W. Randolph st., Chicago.
9th Dist.—J. F. Rehm, 1768 Deming court, Chicago.
10th Dist.—H. D. Hughes, Antioch.
11th Dist.—J. P. Mason, Elgin.
12th Dist.—B. F. Wyman, Sycamore.
13th Dist.—A. N. Abbott, Morrison.
14th Dist.—E. N. Cobb, Monmouth.
15th Dist.—Geo. W. Dean, Adams, R. F. D. No. 1.
16th Dist.—Ralph Allen, Delavan.
17th Dist.—S. B. Mason, Bloomington.
18th Dist.—F. I. Mann, Gilman.
19th Dist.—E. E. Chester, Champaign.
20th Dist.—A. P. Grout, Winchester.
21st Dist.—Edward Grimes, Raymond.
22d Dist.—E. W. Burroughs, Edwardsville.
23d Dist.—A. V. Schermerhorn, Kinmundy.
24th Dist.—Israel Mills, Clay City.
25th Dist.—H. G. Easterly, Carbondale.

STANDING COMMITTEES OF THE ILLINOIS FARMERS' INSTITUTE, 1904.

Executive Committee.

B. F. Wyman, James Frake, H. G. Easterly, A. P. Grout, A. V. Schermerhorn.

Finance Committee.

M. K. Sweet, Edward Grimes, E. N. Cobb, G. W. Dean, B. F. Wyman.

Legislative Committee.

A. N. Abbott, Jacob F. Rehm, F. I. Mann, C. P. Reynolds, B. F. Wyman.

Domestic Science Committee.

E. W. Burroughs, H. A. Aldrich, B. R. Pierce, S. B. Mason, B. F. Wyman.

Ways and Means of Improving County Farmers' Institutes.

Joseph Newman, J. K. Dickirson, John M. Clark, W. M. Manley, B. F. Wyman.

Agricultural Education in the Public Schools.

Alfred Bayliss, Eugene Davenport, F. C. Rossiter, E. E. Chester, B. F. Wyman.

Soil Investigation and Experiments.

Ralph Allen, H. D. Hughes, J. P. Mason, Israel Mills, B. F. Wyman.

Superintendents of Classes at Annual Round-up Institute:

Class in Dairying, Joseph Newman, Elgin.
Class in Corn, E. E. Chester, Champaign.
Class in Horticulture, H. A. Aldrich, Neoga.
Class in Live Stock, Edward Grimes, Raymond.
Class in Poultry, E. N. Cobb, Monmouth.
Class in Soil Fertility, Ralph Allen, Delavan.

B. F. WYMAN, President.

E. W. BURROUGHS, Vice President.

F. I. MANN, Auditor.

FRANK H. HALL, Supt.-Sec'y.

A. P. GROUT, Treasurer.

ILLINOIS FARMERS' INSTITUTE.

OFFICERS, 1905-6.

President, B. F. Wyman	Sycamore
Vice President, E. W. Burroughs	Edwardsville
Superintendent and Secretary, Frank H. Hall	Aurora
Assistant Secretary, H. A. McKeene	Springfield
Treasurer, A. P. Grout	Winchester
Auditor, F. I. Mann	Gilman

BOARD OF DIRECTORS.

Ex-Officio.

Superintendent of Public Instruction, Alfred Bayliss, Springfield.
Dean of the College of Agriculture, Eugene Davenport, Urbana.
President State Board of Agriculture, A. D. Barber, Hamilton.
President State Horticultural Society, H. A. Aldrich, Neoga.
President State Dairymen's Association, Joseph Newman, Elgin.

ELECTIVE BY CONGRESSIONAL DISTRICTS.

1st Dist.—C. P. Reynolds, editor Prairie Farmer, 166 Adams st., Chicago.
2d Dist.—B. R. Pierce, 562 45th st., Chicago.
3d Dist.—M. K. Sweet, Glenwood.
5th Dist.—John M. Houseman, 938 St. Louis av., Chicago.
6th Dist.—F. C. Rossiter, 91 Washington st., Chicago.
7th Dist.—James Frake, 132 LaSalle st., Chicago.
8th Dist.—John M. Clark, 143 W. Randolph st., Chicago.
9th Dist.—J. F. Rehm, 1768 Deming court, Chicago.
10th Dist.—Ralph W. Chittenden, Gurnee.
11th Dist.—J. P. Mason, Elgin.
12th Dist.—B. F. Wyman, Sycamore.
13th Dist.—A. N. Abbott, Morrison.
14th Dist.—Wm. H. Lyford, Port Byron.
15th Dist.—Geo. W. Dean, Adams, R. F. D. No. 1.
16th Dist.—Ralph Allen, Delavan.
17th Dist.—S. B. Mason, Bloomington.
18th Dist.—F. I. Mann, Gilman.
19th Dist.—E. E. Chester, Champaign.
20th Dist.—A. P. Grout, Winchester.
21st Dist.—Edward Grimes, Raymond.
22d Dist.—E. W. Burroughs, Edwardsville.
23d Dist.—A. V. Schermerhorn, Kinmundy.
24th Dist.—J. F. McCartney, Metropolis.
25th Dist.—H. G. Easterly, Carbondale.

STANDING COMMITTEES OF THE ILLINOIS FARMERS' INSTITUTE, 1905-6.

Executive.

B. F. Wyman, James Frake, H. G. Easterly, A. P. Grout, A. V. Schermerhorn.

Finance.

M. K. Sweet, Edward Grimes, W. H. Lyford, Geo. W. Dean, B. F. Wyman.

Legislative.

Jacob F. Rehm, John M. Houseman, C. P. Reynolds, John M. Clark, B. F. Wyman.

Domestic Science.

E. W. Burroughs, H. A. Aldrich, B. R. Pierce, S. B. Mason, B. F. Wyman.

Ways and Means of Improving County Farmers' Institutes.

Joseph Newman, A. D. Barber, Ralph W. Chittenden, J. F. McCartney, B. F. Wyman.

Agricultural Education in Public Schools.

Alfred Bayliss, Eugene Davenport, F. C. Rossiter, E. E. Chester, B. F. Wyman.

Soil Investigations and Experiments.

Ralph Allen, J. P. Mason, F. I. Mann, A. N. Abbott, B. F. Wyman.

AN ACT CREATING THE ILLINOIS FARMERS' INSTITUTE.

Approved June 24, 1895. Amended and Approved May 11, 1901. Amended and Approved May 15, 1903.

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That to assist and encourage useful education among the farmers, and for developing the agricultural resources of the State, that an organization under the name and style of "Illinois Farmers' Institute" is hereby created, and declared a public corporation of the State.

§ 2. It shall consist of three delegates from each county of the State, elected annually at the Farmers' Institutes for said county by the members thereof.

§ 3. The affairs of the Illinois Farmers' Institute shall be managed by a board of Directors, consisting of,

1. State Superintendent of Public Instruction.
2. Professor of Agriculture of the State of Illinois.
3. President of the State Board of Agriculture.
4. President of the State Horticultural Society.
5. President of the State Dairymen's Association, and one member from each congressional district of the State, to be selected by the delegates from the district present at the annual meeting of this organization: *Provided*, That the members first selected from the congressional districts of even number shall serve for one year, and the members first selected from the congressional districts of odd numbers shall serve for two years, and that the members selected thereafter to fill expired terms of office shall serve for the period of two years.

§ 4. The board of directors of the Illinois Farmers' Institute shall have sole care and disposal of all sums that may be appropriated by the State to sustain the organization. and shall expend the same in such manner as in their judgment will best promote the interest in useful education among the farmers and develop the agricultural resources of the State. The Illinois Farmers' Institute shall make annual report to the Governor of its transactions, which report shall include papers pertaining to its work and addresses made at the annual meeting of the organization, and a classified statement of all moneys received and of all expenditures made, and twenty thousand (20,000) copies of said report shall be printed on or before Sept. 1 of each fiscal year, one half for the use of the Illinois Farmers' Institute, and the remainder to the Secretary of State for distribution. It shall make no appropriation without funds in hand to meet the same, and the State of Illinois shall in no event be held liable or responsible for debt, obligation or contract made by the Illinois Farmers' Institute or its board of directors.

§ 5. There shall be held annually, under the direction of the board of directors, between Oct. 1, and March 1, following of each year, a public meeting of the delegates from county farmers' institutes and of farmers of this State, at such time and place as may be determined by the board of directors, of not less than three (3) days duration, which meeting shall be held for the purpose of developing the greater interest in the cultivation of crops, in the care and breeding of domestic animals, in dairy husbandry, in horticulture, in farm drainage, in improved highway, and general farm management, through and by means of liberal discussions of these and kindred subjects and any citizen may take part in these meetings but only duly elected and accredited delegates from county farmers' institutes shall be permitted to vote in the election of the board of directors.

§ 6. (As amended and approved May 15, 1903.) The members of each new board of directors shall enter upon their duties the second Tuesday after their election and hold their offices for one or two years, as provided in section 3, or until their successors are elected and enter upon their duties. The board of directors shall have power to fill vacancies in the board. It shall organize by the election of a president, vice president, treasurer and secretary, who shall hold their offices for one year, their term of office to begin July 1 following their election. It shall employ such superintendents, speakers and clerks as may be deemed proper for organizing and conducting the work of the Illinois Farmers' Institute, and provide for their compensation by the rules of the board of directors. The secretary and treasurer may be other than members of the board of directors. The salary of the secretary shall be two thousand dollars ($2000.00) a year, payable in monthly installments.

The Auditor of Public Accounts is hereby authorized to draw his warrant on the State Treasurer monthly for the salary of the secretary of the Illinois Farmers' Institute, as herein provided, payable out of any fund in his hands not otherwise appropriated.

§ 7. Rooms in the capitol building shall be assigned to the officers of this organization by the proper authority, which shall then be under the control of the board of directors.

§ 8. The board of directors may make and enforce such rules and by-laws, not in conflict with the laws of this State, as will render its work most useful and efficient.

§ 9. For the purpose mentioned in the preceding sections, said board of directors may use such sums as it may deem proper and necessary, not exceeding the amount appropriated therefor by the General Assembly from the general fund for that purpose: *Provided further*, that the

1. State Superintendent of Public Instruction,
2. Professor of Agriculture of the University of Illinois,
3. President of the State Board of Agriculture,
4. President of the State Horticultural Society,
5. President of the State Dairymen's Association,

And the present congressional representatives of the Illinois Farmers' Institute Association shall constitute the first board of directors of this organization, who shall have charge of the affairs of the same until their successors have been duly elected, and enter upon their duties as provided in this act.

AN ACT *Making Appropriation for the Illinois Farmer's Institute and County Farmers' Institutes. Approved May 15, 1903.*

WHEREAS, To assist and encourage practical education among farmers, and for developing the agricultural resources of the State, the 39th General Assemby created an organization under the name and style of the Illinois Farmers' Institute, and intrusted to it the development of greater skill in the cultivation of crops, in the breeding and care of domestic animals, in dairy husbandry, in horticulture, in farm drainage, in improvement of highways and general farm management, through and by means of liberal discussions of these and kindred subjects, and practical instruction for improving the conditions of the farmer by affording a better knowledge of successful agriculture; therefore to sustain the same,

SECTION 1. *Be it enacted by the people of the State of Illinois represented in the General Assembly:* That there be, and is hereby appropriated to the Illinois Farmers' Institute the following sums, to-wit:

§ 2. For clerk hire, type writer, etc., the sum of one thousand dollars ($1,000.00) per annum for the fiscal years beginning July 1st, 1903 and 1904.

§ 3. For expressage, postage, office expenses, furniture, etc., the sum of one thousand five hundred dollars ($1,500.00) per annum for the fiscal years beginning July 1st, 1903 and 1904.

§ 4. For the purchase of books for, and the maintenance and management of, the Illinois Farmers' Institute Free Libraries the sum of two thousand five hundred dollars ($2,500.00) per annum for the fiscal years beginning July 1st, 1903 and 1904.

§ 5. For the actual expenses of the members of the board of directors and officers of the Illinois Farmers' Institute in the performance of their duties as said members and officers, for the expenses of the State Institute meeting, for the employment of specially qualified institute instructors, and for the incidental expenses in promoting the development of the Farmers' Institute work throughout the State, the sum of five thousand dollars ($5,000.00) per annum for the fiscal years, beginning July 1st, 1903 and 1904.

§ 6. For the use of each county farmers' institute for the purpose of holding one or more farmers' institute meetings in each county in the State under the full direction of the county farmers' institute officers of each county, the sum of seventy-five dollars ($75.00) per annum for the fiscal years beginning July 1st, 1903 and 1904, to be paid to the treasurer of each county farmers' institute when such institute shall file with the secretary of the Illinois Farmers' Institute, a sworn statement which shall show that said county farmers' institute has held one or more duly advertised public sessions annually, of not less than two days each at some easily accessible location; which shall include an itemized statement of the expenses of said meeting, with receipted vouchers therefor, a copy of its printed programs, and a report of proceedings showing the title and author of the papers read and by whom discussed, place or places of meeting, with average daily attendance, and such other information as may be called for by the Illinois Farmers' Institute and necessary to successfuly assist this work.

§ 7. No officer or officers of any County Farmers' Institute shall be entitled to receive any moneyed compensation whatever for any service rendered the same.

§ 8. That on the order of the president countersigned by the secretry of the Illinois Farmers' Institute, and approved by the Governor, the Auditor of Public Accounts shall draw his warrant on the Treasurer of the State of Illinois in favor of the treasurer of the Illinois Farmers' Institute for the sum herein appropriated: *Provided*, that each warrant on account of a county farmers' institute shall show the county institute for whose benefit the same is drawn: *Provided further*, that the program and report of proceedings of the county farmers' institute, for which each warrant is drawn, shall show that some of the following topics have been presented and discussed, viz: Grain farming, stock feeding and breeding, dairy husbandry, orchard and small fruit culture, farmers' garden, domestic science, and any subjects pertaining to farm life: *Provided, further*, that if necessary expense of a County Farmers' Institute shall not equal the sum of seventy-five dollars ($75.00) as aforesaid, then said warrant shall only be drawn for the sum expended.

§ 9. It shall be the duty of the treasurer of the Illinois Farmers' Institute to pay over to the treasurer of each county farmers institute the said sum of seventy-five dollars ($75.00) or so much thereof as may be received for its use and benefit, as aforesaid, and make annual report to the Governor, as provided by law.

AN ACT *Making Appropriation for the Illinois Farmers' Institute and County Farmers' Institutes. Approved May 12, 1905.*

WHEREAS, To assist and encourage practical education among farmers and for the developing of the agricultural resources of the State, the 39th General Assembly created an organization under the name and style of the Illinois Farmers' Institute and entrusted to it the development of greater skill in the cultivation of crops, in the breeding and care of domestic animals, in dairy husbandry, in horticulture, in farm drainage, in improvement of highways and general farm management, through and by means of general discussion of these and kindred subjects, and practical instruction for improving the condition of the farmer by affording a better knowledge of successful agriculture; therefore, to sustain the same,

SEC. 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That there be, and is hereby, appropriated to the Illinois Farmers' Institute the following sums, to-wit: For salary of [assistant] secretary, for clerk hire, typewriter, expressage, postage, office expenses, furniture, etc., the sum of two thousand five hundred dollars ($2,500) per annum for the fiscal years beginning July 1, 1905, and 1906.

§ 2. For the actual expenses of the members of the board of directors and officers of the Illinois Farmers' Institute in the performance of their duties as said members and officers, for the expenses of the State institute meeting and for the incidental expenses in promoting the development of the farmers' institute work throughout the State, the sum of five thousand dollars ($5,000) per annum for the fiscal years beginning July 1, 1905, and 1906.

§ 3. For the use of each county farmers' institute for the purpose of holding one or more county farmers' institute meetings in each county in the State, the sum of seventy-five dollars ($75.00) per annum for the fiscal years beginning July 1, 1905, and 1906; said sum to be paid to the treasurer of each county farmers' institute when such institute shall file with the secretary of the Illinois Farmers' Institute, a sworn statement which shall show that said county farmers' institute has held one or more duly advertised public sessions annually, of not less than two days each, at some easily accessible location, which shall include an itemized statement of the expense of said meeting, with receipted vouchers therefor, a copy of its printed program, and a report of its proceedings, showing the title and author of the papers read and by whom discussed, place or places of meeting, with average daily attendance, and such other information as may be called for by the Illinois Farmers' Institute and necessary to successfully assist this work.

§ 4. No officer, nor officers of any county farmers' institute shall be entitled to receive any moneyed compensation whatever for any service rendered the same.

§ 5. That on the order of the president, approved by the director of the congressional district, the secretary of the State Farmers' Institute shall draw his warrant on the treasurer of the State Farmers' Institute, in favor of the treasurer of the county farmers' institute for the sum herein appropriated: *Provided*, that each warrant on account of a county farmers' institute shall show the county institute for whose benefit the same is drawn: *Provided, further*, that the program and report of proceedings of the county farmers' institute, for which warrant is drawn, shall show that some of the following topics have been presented and discussed, viz: Grain farming, stock feeding and breeding, dairy husbandry, orchard and small fruit culture, farmers' garden, domestic science, and any subjects pertaining to farm life: *Provided, further*, that if the necessary expenses of a county farmers' institute shall not equal the sum of seventy-five dollars ($75.00) as aforesaid, then said warrant shall only be drawn for the sum expended.

§ 6. It shall be the duty of the treasurer of the Illinois Farmers' Institute to pay over to the treasurer of each county farmers' institute, the said sum of seventy-five dollars ($75.00) or so much thereof as may be received for its use and benefit, as aforesaid, and make annual report to the Governor, as provided by law.

§ 7. The State Auditor is hereby authorized to draw his warrant for the sums herein specified and deliver the same to the treasurer of the Illinois Farmers' Institute, upon his presenting voucher for the same, signed by the president and secretary of the Illinois Farmers' Institute, and the State Treasurer shall pay the same out of any money in the State treasury not otherwise appropriated.

TENTH ANNUAL MEETING

OF THE

ILLINOIS FARMERS' INSTITUTE

AT

JOLIET, ILLINOIS, FEBRUARY 21, 22, 23, 1905.

LIBRARY BUILDING, JOLIET, ILL.

JOLIET TOWNSHIP HIGH SCHOOL.

ANNOUNCEMENT.

The Board of Directors of the Illinois Farmers' Institute and the officers of the Illinois Association of Domestic Science extend to you a cordial invitation to attend the Tenth Annual Round-up Meeting of the Illinois Farmers' Institute, to be held at Joliet, Ill., February 21, 22 and 23, 1905.

To the officers and members of all county farmers' institutes, farmers, horticulturists, dairymen, live stock breeders and gardeners of Illinois; also to the members of domestic science associations, women's clubs, housekeepers and home makers and all others who are interested in the development of the resources of the State and the up-building of our homes, these meetings will be especially interesting.

WILL BEGIN ON TIME.

The sessions will begin on time, as advertised in the program, with class work in corn-judging and corn-breeding, domestic science, horticulture, live stock, poultry and soils, beginning at 9:00 o'clock a. m. and continuing one hour. It will pay all visitors to be on hand at the opening of the class work. The general sessions will begin promptly at 10:15 a. m., 1:30 p. m. and 7:30 p. m., except the Domestic Science session Wednesday afternoon, which will begin at 2:00 o'clock.

EXCURSION RATES.

Do not forget that an open rate of one and one-third fare for the round trip is granted on all railroads in Illinois. See your local railroad agent in ample time for him to look up the rate, and buy round trip ticket.

ELECTION OF DIRECTORS.

The term of office of the Institute Directors of the even numbered districts expires in March, 1905, and the delegates in attendance at the annual meeting in Joliet from those districts will select directors for the ensuing two years. Only duly accredited delegates from county farmers' institutes will be permitted to vote in the election of the Board of Directors.

JOLIET.

Joliet is a city of 45,000 inhabitants. It is situated on the Desplaines River, with fine hills rising on either side, forty miles from Chicago, and is surrounded by a rich farming country. While a manufacturing city, it is more than ordinarily attractive.

It has 120 industries of various kinds, which employ in the aggregate 15,000 people.

It is about the center of the United States, geographically, and has the finest shipping facilities: Three trunk lines, two branch lines, a belt line crossing every one of the twenty-seven roads which enter Chicago, a belt line of its own and the Illinois and Michigan canal, giving Chicago freight rates and facilities, *minus* Chicago's disadvantages.

It also has the Chicago ship canal which is navigable for lake vessels of twenty-two feet draft to within four miles, and an extension now building to Joliet. This canal, that has cost the city of Chicago over $35,000,000.00, has developed one of the wonderful water powers of the country. As the water supply is drawn from Lake Michigan, the power is reliable.

Joliet has a population of 45,000.

Is forty miles from Chicago, has two east and west trunk lines and one north and south, two branch lines and a belt line crossing every road entering Chicago. Joliet has all of Chicago's advantages and none of her disadvantages.

Has fine electric street car service.

Has two interurban street car lines.

Has a fine electric light and power plant.

Has a splendid gas plant, making gas for three counties.

Has fine streets.

Has $1,000.00 annual saloon license.

Has thirty-nine churches.

Has two hospitals.

Has two orphans' homes.

Has a good water department.

Has a good fire department.

Has the best public schools in America.

And, above all, has INDUSTRIAL PEACE.

The Joliet Township High School, where the Wednesday evening session of the Farmers' Institute is to be held, is separate and distinct from the city schools. The building, which was erected in 1900 costing $250,000.00, ranks second in respect to building, and is admittedly first as to the equipment of its scientific departments, when compared to any high school in the United States. Will accommodate 1,500 pupils and has an enrollment of 1,000. Has a regular course of four years and an additional one of two years, for which advanced credit is given in the *leading* universities of the country. This school, of which the people are so proud, has attracted the attention of educators from all parts of the United States. It is under the management of one superintendent and thirty-one instructors.

LOCAL ORGANIZATION

FOR PROMOTING THE

ILLINOIS FARMERS' INSTITUTE MEETING.

COMMITTEES.

EXECUTIVE—E. L. Wilson, T. A. Mason, Robert Eaton, John T. Clyne, Healy H. Alexander, F. M. Muhlig, Acker Ruhland, Prof. J. Stanley Brown, Wm. Webb, Avery Lambert, L. W. Smith, John B. Gurney, Richard J. Barr and James Martin.

RECEPTION—E. L. Wilson, A. E. Dinet, Walter Rowley, Prof. John J. Allison, John W. Patterson, Mrs. A. Allen Francis, Mrs. John C. Baker, H. C. Wennhoefer, David Morrison, Mayor Wm. C. Crolius, William A. Crawford, John Coldwater, John H. Savage, Mark McClure, George Boardman and Fred Hasenjaeger.

DOMESTIC SCIENCE—Mrs. Charles Francis, Miss Eva Gouger, Mrs. John C. Baker, Mrs. E. J. Murphy, Mrs. A. Allen Francis, Mrs. Louis Conant.

USHERS—Richard Gorman, Alex Haley.

MUSIC—Prof. J. M. Thompson, Levi M. Hall, Charles H. Tallcott, George A. Brewster and Walter S. West.

ADVERTISEMENT AND PRESS—W. A. Baldwin, Charles W. Wheeler, Frank H. Hall, W. S. Blakely and John Adams.

FINANCE—H. H. Stassen, E. L. Wilson and John W. Patterson.

PROCEEDINGS OF THE ILLINOIS FARMERS' INSTITUTE AT THE ANNUAL MEETING HELD IN JOLIET, FEB. 21, 22, 23, 1905.

GENERAL SESSION, OPERA HOUSE, 10:15 A. M., FEB. 21.

The first general session of the tenth annual meeting of the State Farmers' Institute opened at 10:15 in the Joliet theatre with President Wyman in the chair, who briefly addressed the meeting as follows:

LADIES AND GENTLEMEN—I did not, as is the usual custom, prepare an address for this occasion but preferred to give the meeting over at once to those who are here to do the work. I wish to say, however, that the people of Joliet and Will county are to be congratulated and commended for their interest in the work of the Illinois Farmers' Institute. The attendance at the morning classes has been remarkable, and when all the delegates and others who have been delayed by late trains arrive, I have no doubt we shall have the largest gathering in the history of the institute. But I am not here to take your time. I am here to participate in the work with you. At this meeting much of the future work of the institute will be formulated and plans for the coming year will be made.

President Wyman then announced the following committees:

CREDENTIALS.

Director M. K. Sweet, Third Congressional district, Glenwood.
Director S. B. Mason, Seventeenth Congressional district, Bloomington.
G. A. Crowden, Twelfth Congressional district, Ottawa.

RESOLUTIONS.

Director James Frake, Seventh Congressional district, Chicago.
Director H. G. Easterly, Twenty-fifth Congressional district, Carbondale.
Director E. W. Burroughs, Twenty-second Congressional district, Edwardsville.

On motion of Director Frank I. Mann of Gilman, the institute voted to refer all resolutions to the committee.

The president then introduced Mr. Frank H. Hall of Aurora, superintendent of the farmers' institutes.

FRANK H. HALL.

REPORT OF SUPERINTENDENT HALL.

There have been held in the State thus far this year, 106 institutes. Two counties have held no institute, Edgar and Schuyler; and six counties have held two institutes each, Hancock, Lake, Champaign, Pope, Henry and McLean. The Edgar county institute will be held March 1 and 2 but so far as known no arrangements have been made for the institute in Schuyler county.

The superintendent recently requested the assistance of the officers of the county institutes in making certain estimates in regard to the attendance upon institutes that are not called for in the official report to the secretary. Prompt response came from ninety counties and the following figures are believed to be approximately accurate and therefore of some value for statistical purpose.

INSTITUTE ATTENDANCE OF CERTAIN CLASSES FOR THE YEAR 1904-5.*

Farmers	20,000
Farmers' wives	10,000
Teachers	2,000
Pupils	20,000

The word "farmers" is supposed to stand for all those who are directly financially interested in agriculture. The actual attendance as reported to the secretary will be somewhat larger than the figures here given since many who attend the institutes, (who are always welcome and whose assistance and encouragement are earnestly sought and appreciated), are only indirectly interested in the dissemination of agricultural information—are not really farmers in the sense in which the word is here used. The figures are desirable as indicating to what extent the men who are engaged in producing things from the soil are availing themselves of the instruction offered at the institutes. There are at least 500,000 farmers in this State; 20,000 attend the institutes—one of every twenty-five. There are about 27,000 teachers in the State. More than 2,000 of these attended the farmers' institute this winter—one in thirteen. But the 2,000 teachers come in touch with 40,000 pupils and with many of the parents of these pupils. May we not hope that through this teacher attendance, we may reach many of the 480,000 farmers who do not attend institutes as well as some of the 500,000 and more who will make up the next generation of farmers? Verily, the public school is a main factor in promoting the new agricultural education. A. J. Bill of the Bloomington Pantagraph tells of a farmers' institute in Illinois that was attended by 50 per cent of the teachers of the county and less than 2 per cent of the farmers.

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* The total attendance reported is 62,928.

COST OF INSTITUTES INCLUDING PREMIUMS ON EXHIBITS.

Five counties expended less than $75.00 each.
Seventeen counties expended from $75.00 to $100.00 each.
Thirty-nine counties expended from $100.00 to $200.00 each.
Eleven counties expended from $200.00 to $300.00 each.
Six counties expended from $300.00 to $400.00 each.
Four counties expended from $400.00 to $500.00 each.

Five counties, Lawrence, Mason, Ogle, Tazewell and Will, expended more than $500.00 each, the largest amount reported being from Will county—$635.00.

AMOUNTS FROM BOARDS OF SUPERVISORS.

Boone	$ 50 00	Lee	$ 50 00
Bureau	75 00	Livingston	10 00
Crawford	100 00	Logan	150 00
DeKalb	150 00	Macoupin	150 00
Effingham	75 00	Madison	100 00
Ford	50 00	Mason	100 00
Gallatin	75 00	Ogle	100 00
Grundy	50 00	Sangamon	38 70
Henry	75 00	St. Clair	50 00
Iroquois	100 00	Tazewell	50 00
Kane	200 00	Will	150 00
Lawrence	300 00	Winnebago	200 00

AMOUNTS RECEIVED FROM SOURCES OTHER THAN THE STATE TREASURY OR THE COUNTY BOARD, INCLUDING CASH OR MERCHANDISE GIVEN AS PREMIUMS.

Thirteen counties $0.00.
Sixty-six counties from $5.00 to $190.00.

Lawrence	$200 00	Montgomery	$341 00
Ford	200 00	Tazewell	350 00
Piatt	205 00	Will	360 00
McLean	220 00	Mason	390 00
Henry	250 00	Ogle	401 00
Logan	252 05		

SPEAKERS.

More than 90 per cent of the institutes had speakers from the State Experiment Station and every county had one or more speakers in close touch with this source of life to the institutes. The superintendent cannot commend in too strong terms those county officers who have insisted that their programs should be strengthened by placing upon them the names of two or more of those men who are "doing things" at the experiment station; who are giving us something of value to disseminate and without whose services there would have been no institutes at all—at least none on the magnificent scale upon which they are built.

The measure of the value of an institute is the closeness of its relationship to the sources of scientific knowledge. Hence it is with greatest pleasure that I read the following:

NUMBER OF INSTITUTES ATTENDED BY SPEAKERS FROM THE COLLEGE OF AGRICULTURE AND EXPERIMENT STATION AT URBANA.

	1903-4	1904-5		1903-4	1904-5
Dr. C. G. Hopkins	26	15	Prof. J. C. Blair	2	3
Mr. J. H. Pettit	20	17	Mr. J. W. Lloyd	0	5
Dean Eugene Davenport	5	9	Mr. C. F. Crandall	2	3
Mr. J. E. Readhimer	4	16	Prof. Isabel Bevier	4	5
Mr. A. N. Hume	7	9	Mrs. Gertrude Sober	3	8
Mr. L. H. Smith	8	0	Miss E. C. Sprague	1	0
Mr. J. G. Mosier	2	4	Prof. W. J. Fraser	0	9
Mr. E. M. East	4	0	Mr. A. J. Glover	18	7
Mr. F. R. Crane	7	10	Mr. H. A. Hopper	0	4
Mr. R. C. Lloyd	2	0	Mr. C. C. Hayden	0	3
Mr. I. O Schaub	0	6	Dr. D. McIntosh	0	2
Prof. H. W. Mumford	15	25	Supt. Fred H. Rankin	28	11
Mr. L. D. Hall	1	4			
Mr. R. C. Obrecht	0	9	Total	159	187
Mr. Wm. Dietrich	0	3			

INSTITUTES ATTENDED BY OFFICERS OF THE STATE FARMERS' INSTITUTE.

	1903-4	1904-5		1903-4	1094-5
Pres. B. F. Wyman	....	7	Treas. A. P. Grout	12	15
Vice Pres. E. W. Burrows	....	6	Auditor F. I. Mann	3	4
Sec. A. B. Hostetter	....	15	Supt. Frank H. Hall	45	56

CO-OPERATION OF THE COUNTY SUPERINTENDENTS OF SCHOOLS.

The county superintendents of schools, of whom special mention was made in my last report as zealously coöperating with the institute officials, have been no less helpful and efficient in the institute work this year. It is through these men and women that we are able to reach to some extent, the rural schools. It is quite within reasonable bounds to say that thousands of young people through the efforts of these officials and the superintendents of city schools supported and encouraged by the State Superintendent of Public Instruction, Alfred Bayliss, have this year been brought face to face for the first time, with some of the interesting revelations of the new agriculture. The pupils in the higher grades of our schools are learning to read the "literature of information" that reveals the marvelously interesting truths of twentieth century agriculture. Many of them will no longer shy at the words protein and carbohydrates and nitrogen and phosphorus and potassium. To many of them the school work is already becoming more closely related to their prospective life work. More of them than ever before have their faces turned towards the experiment station and the agricultural college. We need the continued assistance of these county school officers. It is usually a happy combination when the county superintendent of schools becomes the secretary of the county farmers' institute.

In several counties there were what have been called "combination institutes," in which, at the call of the county superintendent of schools, many of the teachers of the county were present, and had some part on the program. Such plan was adopted in each of the following counties with encouraging success:

	Teachers	Pupils		Teachers	Pupils
Alexander	....	....	Lake	10	300
Bond	60	120	Lawrence	85	1,200
Cook	....	....	Lee	....	100
DuPage	....	....	Marion	200	600
Franklin	50	100	Mason	45	1,400
Hamilton	90	300	Massac	25	250
Jackson	20	125	McLean	....	150
Johnson	100	40	Union	30	100
Kane	100	200	Winnebago	50	400
LaSalle	25	25	Woodford	75	50

Many of the county superintendents of schools for the above named counties, issue calls to their teachers, similar to that sent out by Supt. Snyder, of Alexander county, which is here given in full:

To School Officers and Teachers of Alexander County:

You are hereby notified that the annual meeting of the Teachers and Farmers is to be held at Olive Branch, Friday and Saturday, Nov. 18 and 19, 1904.

School officers are requested to permit all teachers who ask to dismiss their schools on Friday, November 18, to grant the request and count it as a day taught. The school law grants the county superintendent the privilege of calling the teachers of the county together for five school days in each year and the time is not lost by the teacher, if that teacher attends the called meeting. If the teacher attends there is no question but that the inspiration and information gained will fully repay for the dollars and cents received for the day's work. If the boards of directors require the teacher to turn in a certificate of attendance the county superintendent will be pleased to give a certificate for the same.

Directors, if your teachers tell you they are going to attend, I vouch for their attendance without the certificate. Our teachers are honest, truthful and worthy.

I would be pleased to see every school officer, and every teacher in the county at the institute and make it one of the best union institutes ever held in Alexander county.

Below is the program in full and every citizen of the county is extended a cordial invitation to be present.

You cannot afford to miss a single session and the expense will be very light.

The Ladies' Aid of Olive Branch will serve dinner on Friday and Saturday.

Olive Branch is centrally located and it will be a delightful drive from any part of the county. The moon will be full, the roads good and the weather mild. Come and let us reason together.

Most respectfully,
JOHN SNYDER,
County Superintendent.

The following names of school superintendents and prominent teachers appear upon the program of the Farmers' Institutes and are an indication of the interest the educators of the State are taking in agricultural education:

State Superintendent Alfred Bayliss, Springfield, Ill.
Assistant Superintendent J. E. Bangs, Springfield, Ill.
County Surerintendent O. J. Kern, Rockford, Ill.
County Superintendent U. J. Hoffman, Ottawa, Ill.
County Superintendent S. J. Ferguson, Rock Island, Ill.
County Superintendent Chas. Hertel, Belleville. Ill.
County Superintendent R. L. Lowry, Upper Alton, Ill.
County Superintendent C. H. Watts. Urbana, Ill.
County Superintendent Caroline Grote, Pittsfield, Ill.

County Superintendent Mrs. H. M. Smith, Mound City, Ill.
County Superintendent John Snyder, Cairo, Ill.
County Superintendent Ralph Holmes, Danville, Ill.
Assistant County Superintendent Chas. W. Farr, Chicago, Ill.
County Superintendent T. W. Biggerstaff, McLeansboro, Ill.
County Superintendent W. F. Boyes, Galesburg, Ill.
County Superintendent Wm. Harlon, Greenville, Ill.
County Superintendent H. M. Tipswood, Toledo, Ill.
County Superintendent Hattie Rittenhouse, Elizabethtown, Ill.
Superintendent Jos. Carter, Champaign, Ill.
Professor S. E. Harwood, Carbondale, Ill.
Professor G. H. French, Carbondale, Ill.
Professor H. W. Shyrock, Carbondale, Ill.
Professor W. T. Felts, Carbondale, Ill.
Dr. David Felmley, Normal, Ill.
Professor J. P. Stewart, Normal. Ill.
Professor F. L. Horn, Clinton, Ill.
Professor C. C. Covey, Farmer City, Ill.
Professor M. T. Van Cleave, Mound City, Ill.
Professor W. N. Draper, Fairfield, Ill.
Professor F. C. Blair, Charleston, Ill.
Professor S. H. Trego, Clayton, Ill.
Professor A. C. Butler, Abingdon, Ill.
Miss Alice Reed, Cairo, Ill.
Miss Ethelda Morrison, Mt. Carroll, Ill.
Professor J. W. Hayes, Urbana, Ill.
Professor C. W. Nash, Clay City, Ill.
Professor W. H. Pyle, Vandalia, Ill.
Professor Fred W. White, Galva, Ill.

At the Alexander County Institute, Hon. H. G. Easterly spoke on "Farmers' Institutes," Teacher Nelson Croft on "Teachers' Institutes" and Supt. Jno. Snyder on "The Happy Union of the Two."

In at least thirty counties the pupils of the eighth grades and of the high schools in the city in which the institute was held, were allowed to attend one or more sessions of the Farmers' Institute.

Particularly interesting sessions of this kind were held in Assumption, Christian county; Newton, Jasper county; Mt. Herman, Jefferson county; Plano, Kendall county; Abingdon, Knox county; Carlinville, Macoupin county; Troy, Madison county; Nokomis, Montgomery county; Cerro Gordo, Piatt county; Olney, Richland county; Mackinaw, Tazewell county; Marion, Williamson county.

In several towns the superintendent of the institutes accepted invitations to address the pupils and teachers in the high school buildings, on agricultural topics. He remembers with pleasure in this connection, Greenville, Bond county; Arcola, Douglas county; Fairfield, Wayne county.

AGRICULTURE IN THE SCHOOLS.*

The superintendent finds that a large number of the city and in a few of the rural schools, attempts are being made to introduce the elements of agricultural science and of domestic science into the course of study. Leading educators approve this move, but nobody as yet knows exactly what to do or how to do it. All along the line the work is tentative. The State Normal Schools are all giving invaluable assistance in the solution of the problem. They will soon begin to send out teachers who are somewhat familiar with what is being done by the U. S. Department of Agriculture and at our own experiment station at Urbana.

It is proper that special mention should be made of the work of Prof. French of the Southern Normal, and Prof. Harwood of the same institution, and of the attitude of its president, Dr. D. B. Parkinson, towards the work of the Farmers' Institute.

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*For additional facts concerning the teaching of agriculture in the public schools, see pages ...... of this volume.

Some work in Forestry is being done at the Eastern Normal, and the Northern Normal is arranging its course to meet the needs of the rural school teachers, in their efforts to make pedagogical use of the environment of country pupils.

The Western Normal opens its doors to the McDonough county institute, and teachers and pupils attend the meetings.

The fact that Dr. David Felmley of Normal was asked to take a place on our program for the domestic science sessions, is evidence of the estimate placed upon his work by those in charge of that department of our organization, while his frequent appearance at county institutes on educational topics, and his able address before one of our horticultural societies, makes it plain that he is helping to bring the new education and the new agriculture into harmonic relationship.

THE INSTITUTE CIRCUITS.

In accordance with the instruction of the board of directors, the superintendent made effort to have the dates of county institutes and the topics on the programs, so arranged, that speakers might travel in "Circuits," thus making a saving of money and strength. In some districts this plan was cheerfully accepted and faithfully adhered to. In others, owing to previous arrangements or a lack of harmony, or local misunderstanding, or indifference, the effort was abortive.

The result in two specific cases will illustrate the advantages of the plan and the difficulty of execution.

First. In the Twentieth district Dean Davenport made a circuit of four counties in four consecutive days, without losing sleep, and having something more than a half day in each institute, at a cost of less than $4.00 per institute.

Second. In another district it was arranged that the Dean should make a circuit of three counties on three consecutive days. This he could have done for about $3.00 per county. One of the counties held its institute several weeks before the time fixed for it at the conference; a second county did not put the Dean on its program; the third followed the conferance plan and the Dean made the trip at a cost of about $7.00 and was only at the meeting about one and one half hours.

Under the old method of program making, the superintendent in the winter of 1903-4 made four trips from Aurora to southern Illinois for four institutes. Under the new plan , he made one trip from Aurora to southern Illinois for four institutes.

Under the new plan the superintendent was able to visit fifty six institutes as against fiorty five the year before, while the distance traveled was at least 2,000 miles less than in the former session. A corresponding saving was made in the expenses of nearly all speakers who were employed for complete circuits.

NEW FEATURES.

There are several new features in the institute work, of which mention should be made.

1. In Scott county, Director Grout offered a premium to the boy under eighteen years of age, who would show the most skill in judging corn. Nineteen boys appeared as contestants. These were given several hours training by an expert corn judge, and were then tested by requiring each pupil to score ten ears of corn furnished by the judge. The winning boy was given a trip to Urbana, and two weeks of work in the corn school in February, the entire expenses being paid by Director Grout himself.

Other counties are considering the matter of offering a premium of this kind next year. It has been suggested that the Exhibits at an institute might be sold, and the proceeds devoted to sending one or more pupils to the winter corn school at Urbana.

2. In two counties, the score card was used in judging the bread. In several counties the butter was judged by the card. Many are urging the judging of bread by the card at all the institutes next year. Others have in-

dorsed this movement. Desirable as this may be, the superintendent discovers some obstacles in the way of its accomplishment. Before we could judge our corn by the card, it was necessary to train up a body of "expert corn judges." So in the matter of the bread; the first necessity is a number of expert bread judges. The superintendent suggests such organized effort as will result in sending to the Housekeepers' Conference next winter, a number of persons who will attempt to prepare themselves for expert work of this kind. This done, the way will be open for training our girls, not only in bread making, but in bread judging. It is possible that a beginning might be made at the State fair school in September.

3. In Fulton county, unusual skill was shown in advertising the institute and at the same time in making it educational. I can do no better than to reproduce a part of the report of the secretary, K. H. Quick, of Fiatt. He says:

"We tried some new features in the institute work of Fulton county this year which were successful. We offered ten dollars ($10.00) in three cash prizes to the boys and girls under eighteen years of age in Fulton county who would participate in an essay writing contest, taking as a subject "The Possibilities of an Eighty Acre Farm Without Capital." Rules governing this contest were that essays should contain not more than 1,000 words, and prize winning essays should be read by their writers at some session of the institute. The essays were turned over to Dean Davenport to be judged. Some practical and interesting essays were submitted, and we consider this a feature worth adopting. County Superintendent M. M. Cook very kindly aided in advertising this by sending out printed matter to the teachers of the schools of the county".

"Another feature in the way of advertising the institute which we found very advantageous in creating sentiment, is as follows: I asked different men who had been connected with the institute work, to write short articles in commendation of the program, speakers or subjects, to be used as press notices in the local papers of the county. All the publishers were supplied with these articles and urged to co-operate with us in bringing the program before the public."

SUGGESTIONS.

1. It will be productive of economy and efficiency to so arrange the dates and programs for the next year's institutes that the "circuit plan" may be put into operation in all parts of the state as perfectly as it was in several of the congressional districts, this year.

To do this, each county must be represented at the district conference. The delegate should go prepared to express the wishes of the people of his county (1) as to the place of holding the institute, (2) as to the date of the meetings, (3) as to the topics to be discussed, and (4) as to the speakers from the station and elsewhere outside the county.

But the delagate should be allowed sufficient latitude in deciding these matters to enable him to participate in such compromise as to dates and speakers as will make the organization of his district into institute circuits, possible. Moreover, neither the county officers, nor the program committee, should change the location agreed upon at the conference, or the date, or the topics to be discussed by speakers from the station, or elsewhere outside the county, except for the most urgent reasons. Whenever such change seems inevitable, it should be done through the director, who will at once communicate with the superintendent. In this way only can there be such efficient organization as will result in economic expenditure of time and money.

2. Programs should not be crowded. Ample time should be allowed for the discussion of important topics. Each speaker should be given and held to the time alloted him. This time should be long or short according to the topic and the man. To avoid embarrassment, the speaker should be told when he takes the stand exactly how much time can be devoted to the topic he is to present, and under no ordinary circumstances should he be allowed to encroach upon the time set apart for another topic.

3. Speakers whose services are of sufficient value to place their names on the program at large expense, or speakers from our college and station who are doing the work that gives life and character to the institutes, should be given one long period or two periods of medium length on every program on which their names appear. It is anything but ecomony and business sense to bring such men before the institute for a half-hour talk.

In conclusion, I beg to thank our executive committee and all the members of the board of directors and the school superintendents and teachers, and the officers of the county institutes, for innumerable courtesies that have made my work, during the year, a constant pleasure. It is a privilege to be a teacher. It is a delight to be a farmer. To be both is honor enough for any mortal; for as Bro. Elbertus says: "The noblest occupation a man can follow is to teach men and women how to be happy through usefull activity, and to make two ears of corn grow where one burdock and two jimson weeds grew before."

President Wyman announced that the remaining thirty minutes of the session would be devoted to questions, answers, discussions and suggestions relative to the work of the institute.

Delegate—Where are the conferences held that determine the date for the county institutes?

Superintendent Hall—The director, after consulting with the superintendent, determines the time and place for the district conference. The director notifies the county officers. The conferences are held in March or April.

Delegate—I would like to make one recommendation to program committees. If they have a country subject, don't put it on in the evening to entertain city people, when few country people are present. If a vaudeville for the city people is desired, have it in the evening; but if the subject is for country people put it on when country people will be there.

Director McCartney—I avail myself of the invitation extended by Superintendent Hall to say that he entirely omitted Massac county, where both the county superintendent and city superintendent appeared upon our program and the high school was there in a body. I think it must have been on a day after Superintendent Hall was with us.

Superintendent Hall—No, I was there; and it was a great meeting. If I did not report it, it was an oversight on my part. I remember all about it. When the time came for the opening of the meeting, you put your head out of the window and called the people and they came from all over the county. Your county superintendent made one of the best addresses that I have heard. (Referring to manuscript.) I have in my report, I cannot say whether or not I read it, "Massac county, twenty-five teachers and 250 pupils in attendance."

Director McCartney--You omitted the county. We don't want it understood that because we are down in the southern part of the State we are to be overlooked.

Secretary Hostetter—I want to call the attention of the delegates to the banners that represent the farmers' institute in each township; and I know it will help the delegates from other parts of the State if some one from Will county will explain how they manage these township organizations.

President Wyman—Perhaps Mr. Wilson, the president of the Will County Farmers' Institute, will explain.

Mr. Wilson—I cannot well explain all these matters, for I have not been in the county long enough to do this. The banners are supplied by the different townships. We have a vice president for each township; and these vice presidents are workers and the people of the township take pride in their organization, especially those near Joliet. All that have banners are not here now but we hope before the close of the meeting that all will be present.

In the matter of collections, we have the different vice presidents in the townships solicit among their own people and these have gone out among our farmers and endeavored to collect enough for our running expenses. We have several farmers' organizations in this county. We have, first of all, the Wheatland Plowing Match, you have all heard of that. If you haven't heard of it, Friend Patterson can tell you about it. If you live within a convenient distance for reaching this plowing match be sure to attend it. I attended it last year and saw some plowing that was just wonderful. Then we have township fairs. Jackson township has a fair of its own. Plainfield has a fair of its own. Peotone has a fair with two or three other townships—all these besides the county fair. All these organizations contribute to our success. Then we have an organization of women. We have no regular domestic science association, but we have a woman's association, Mrs. Baker being the first president and serving, I think, three years. Mrs. Francis is the present president of that organization. We have all worked together and I think that is one of the secrets of our successful institutes. [Applause.]

Superintendent Hall—May we hear from Mrs. Baker, the former president of the women's association, and from Mr. Patterson, the father of the Wheatland Plowing Match?

Mrs. Baker—In addition to Superintendent Hall's report I want to add an item which applies to Will county in respect to the new feature in our work. Two years ago the women's association of Will county introduced this new feature, offering a prize to the boy and the girl, one to the girl and one to the boy, for competitive essay writing. The premium was a scholarship for one year to our Joliet township high school, of which we are very proud. The essays were limited to pupils in the eighth grade in the country school. We eliminated pupils from large towns and from villages in order to make it a feature entirely for pupils from the country. They wrote on different topics, the boys on one and the girls on another. There were eighteen essays sent in and these were judged by a committee of high school teachers of the Joliet township high school. The next year the premium was offered to the girl who would write the best essay on the various uses of corn meal. This premium went to a farmer's daughter from Jackson township.

Mr. Patterson—I have listened to Friend Hall's report with a great deal of interest. He said something about domestic science. I don't know exactly what domestic science is, but I once talked to a good lady, and we have an awful lot of good ladies in Will county, about domestic science and she said we did not need any domestic science in Will county that every farmer's wife was a good housekeeper and a good cook. Is that all that is needed in domestic science?

Superintendent Hall—For reply to your question I refer you to the president of the domestic science association.

Mr. Patterson—Then there was another thing the professor talked about a good deal; and that is about having the scholars and teachers and farmers meet together. Now, sir, the farmers of Will county can fill the biggest hall in Will county. If we bring in the school children and the school teachers the farmers will have to go out. Would that be the best thing to do?

A Delegate—Hold it out of doors whore there are no walls.

Mr. Patterson—It is too cold in the winter. We like to be comfortable up here. We have a good house and we can fill it chock full. When Professor Hall was talking about bringing in those teachers and scholars I did not see what we could do with them, but may be he can suggest a way out of that trouble.

Then there are a good many township organizations of different kinds in Will county, fairs and plowing matches. The plowing match was probably the first township organization of any kind in the county. It commenced about 1876 and it has been a constant yearly thing ever since. I used to think that the Wheatland Plowing Match was a very small affair, a local affair, 'till Mr. Bradley told me that we compelled him to change his system of plows, and he says, "Not only that, but you compelled every plow factory in the State of Illinois to manufacture a better plow and a different style of plow." When I was down to Urbana I told the people there that the Wheatland Plowing Match had affected more farmers than Urbana institute. They did not seem to like that very well. Naturally they wouldn't. But I said that if we had caused every plow to be changed, and to be changed for the better, we had affected every farmer in the State of Illinois. The Wheatland Plowing Match is a small affair and sometimes it was very hard work to secure the money necessary to carry it on. But we always got it some way and never had any State appropriation either. We are down on State appropriations. We don't like them. We think the farmer is a big man. He is the wealthiest man—the farmers are the wealthiest class—in the State of Illinois today and consequently ought to be independent. They ought not to go begging. I don't want the farmers to be paying court to the State of Illinois or Chicago or any other place. I want them to be independent, pay their own way. I don't like these appropriations. If one institution has a right to an appropriation, all other institutions in the State ought to have an appropriation. I don't know as I better say any more. May be I better sit down, I guess I will.

Superintendent Hall—I feel under great obligation to my friend Mr. Patterson for all he has said and I feel equally under obligation to him for sitting down just when he did. He knows when to stop as well as when to begin.

Mr. Patterson—Not many men know when to stop.

Superintendent Hall—I want to say that after I have listened to what Mr. Wilson and Mr. Patterson have said, I am convinced that there is not a county in the State so well organized, organized exactly as our leader, the Hon. John Hamilton says we ought to be, as Will county. You say you already have your township organizations which is exactly what we want.

Mr. Patterson—No, sir, we have no township organization.

Superintendent Hall—For what do these banners stand?

Mr. Patterson—They stand for people that are better off than we are in Wheatland. We cannot afford a banner.

Superintendent Hall—We'll get an appropriation for you.

Mrs. Baker—With Mr. Wilson's consent, I want to make a correction. I want to explain a little more fully about the banners. Mr. Wilson's predecessor, Mr. Alexander, whom everybody in Will county knows, should have the credit for getting up the banners. While he was in office he requested that these be made and he picked his women out of each township to make them. He asked a certain woman in each township to prepare a banner for the next institute. She had the privilege of selecting her own design, of getting whomsoever she pleased to make the banner, or to make it herself; to pay for it herself if she wanted to or to collect from the township for it. There was a very generous response. Let me call your attention to the new banner put up within the last five minutes. Frankfort had never sent a banner to the institute before. You all see it for the first time. I think we better cheer Frankfort. [Cheers.] There are now in the county, including Frankfort, ten township banners. There is also a Will county banner. I don't wish to contradict Mr. Wilson. He does not understand it as well as I do. There is no township organization connected with the banner.

Mr. Wilson—Mrs. Baker is more familiar with this matter than I am and I am glad she has made this correction

Superintendent Hall—Surely no one would think for a moment that a township organization could be harmful. As I understand Mr. Wilson, people in the various townships have coöperated with him in raising the funds necessary to defray the expenses of the institute. This is certainly a step towards township organization. Surely this is a banner county in a double sense. You have banners and you had the largest attendance at your county institute last year of any county in the State. It was so reported by me at Decatur. This, I think, is the result of efficient organization. Surely these banners stand for something with reference to the interest in the farmers' institute in the townships whose names are printed upon them.

Mr. Baker—I was at the first institute ever held in this county, and have been at all of them ever since. There has been in this county a greatly growing interest in the institute, although the first institute was well attended by the farmers of the county. But there was no organization, properly speaking, until late years, when a vice president has been appointed in each town, and he is always requested to collect money in his town. Some towns have collected as high as $50.00 or $60.00, and in some towns the vice presidents have done nothing and collected nothing. The way we do is to take up a collection for expenses. Our expenses have always been quite high.

For instance, we have to pay $100.00 for this hall, and we have music and speakers, and our expenses are hardly ever less than $300.00 or $400.00, and that was always paid by donation by the farmers of the county. It was done by voluntary contributions in that way until late years they have had these organizations through the town, asking them to collect. I don't know that it is any more successful. The institute has been successful because the farmers of Will county are successful. That is the point of the whole thing.

Mr. Rowley—My friend, Mr. Patterson of Wheatland, referred to State appropriations for the maintenance of our county institutes, and Mr. Hall referred to an admission fee of 10 cents in his report. This admission fee of 10 cents I have always approved and advocated at our executive meeting, and I would like to ask if we would be deprived of our State appropriation in case we should make a charge of 10 cents.

Superintendent Hall—I do not think so. I do not see any reason for it, provided two sessions are held each day, for admission to which no fee is charged.

Mr. Holland—I didn't think Mr. Hall would go back on Lake county. I did not hear him report anything about Lake county.

Superintendent Hall—You have not sent your report to me.

Mr. Holland—I want to say further that our county superintendent was with us through all our farmers' institute, and also through our district institute, and we had quite a number of pupils in our district institute at Waukegan. We had with us about 300 pupils, and also the superintendent in active work in the Waukegan schools. I don't want you to think they did not coöperate with us at all. I am sorry our secretary did not send in a report to Superintendent Hall.

Mr. Crowden—Mr. Hall's report in regard to organization has interested me a little bit. At our county institute we used to play the hat game. Whenever we decided where to hold it we would go around to the merchants and get enough money from them to carry on the institute. Then we got the idea that probably the supervisors would help us a little, and two years ago we asked an appropriation of $200.00. After some discussion and a good deal of fighting they made it, but the local press took up the fight against it and said we obtained money illegally. Well, that $200.00 we got two years ago. I was secretary at that time, and am yet. We became economical and saved every cent of that $200.00 we got from the county, because we knew we would never get another appropriation, and we carried our institute with the least expense we possibly could. This year we had enough money held over, with a little addition, to run the institute. But we got tired of that. On our second day our president got up and scored our farmers in pretty good shape. He said that a county like LaSalle running an institute where a few had to contribute the funds to run it was a pretty poor example. So we started out to organize, and we got $61.50 and sixty-two names right there that afternoon in perhaps ten minutes time, to start an organization. As secretary I expect to get a book and keep an account with each member and add as many names to that as possible. I would like to hear more about Mr. Hamilton's work on organization. I think if we could get 5,000 members in LaSalle county, and other counties in proportion, the State of Illinois could make a good showing of its farmers to the Legislature. When we ask for anything they will give it to us. I am not advocating politics in farmers' institutes, and yet we want something once in a while. If we have a big organization they will give us something.

A Delegate—We have held our institute with a full house, but the farmer was not there. I would like to know how we are going to bring out the farmer—the farmer who does not look on the bright side of farming?

Voice—See that Mr. Hall is there.

The Delegate—The supervisors of our county give us what money we ask. We always have a good program and a full house, but the renters, the actual farmers who ought to be there, are not there. That is what we want to do, get out the genuine farmer. Of those who are retired, many of them are always there, but the actual working farmer is the man that needs the advice, and it is hard to get him out. We don't have the men there we would like to have.

Mr. Patterson—I would like to suggest to the gentleman that his county gives far too much money. If they did not get any money from the supervisors they would have to get out and work, and consequently would have got in the members.

Mr. Wheeler—I would like to ask if it is usual to hold farmers' institutes at the county seat, or is it customary to change them about in the county?

President Wyman—That rests entirely with the people themselves. The custom in some places is to hold them at the county seat, and other places to move them around.

Mrs. Harper—Professor Hall spoke of our appropriation from the board of supervisors. It was not for the farmers' institute, although the funds were delivered over into the hands of the treasurer of the farmers' institute; but the appropriation was made for the boys' corn contest and the furtherance of the girls' home improvement club. We were just beginning and did not have the funds to carry out that work as we wished to do. And in reference to the gentleman's remarks about how to get the farmer out, the actual farmer; you bring his boys and his girls out to the institutes, and then you will get him. [Applause.]

Director S. B. Mason—I presume that is something similar to the organization scheme that I sent around. I still have some copies of that suggestive program which I can mail to those who would like to have them. Instead of an admission fee we have a membership fee of 25 cents. You cannot get a man interested very much until he gives you some money. If somebody would ask what they would like to know I can answer questions easier.

Superintendent Hall—How many counties in your district are organized?

Director Mason—Practically four. Some of them think it is the thing they have been looking for. They do not know how they managed the institute without organization.

A Delegate—Do you adopt a constitution and by-laws for your government?

Director Mason—Yes, sir. We undertook two or three things in our county this year, and one was an excursion to the college at Urbana. We thought perhaps we would take 100 or 200 people, and when we got ready to go we had 500 people. We are going to try that again. That helped the interest as much as anything we could have done. And it did not cost us any money. It paid its way. Another thing that helped to create increased interest this year was the coöperation of the county superintendents of schools. Two of them kindly dismissed their schools and brought their teachers and scholars to the institute to hear Superintendent Hall. That was in Woodford and McLean, and the county superintendents are entitled to a good deal of credit. I think the superintendents all over the State should help the institute. By and by the whole thing in the State will be agriculture and nothing else.

Mr. Wilson—How large a membership have you in your own county?

Mr. Mason—Not as large as it ought to be. It has not been managed very well, and it is about a hundred now. I don't know about Woodford.

Mr. Wilson—In this county it takes more money to run institutes than it does in any other county. We have tried to cut expenses as much as we could, but we would have to raise the membership of this county. In my own home town they have raised $50.00, and I doubt whether we could raise $5.00 more. Every farmer in the township has been touched. Of course that is $1.00 apiece for the majority of them, but they have a goodly string of dollars, and at 25 cents apiece every one in the county would need to contribute to run our institute, I think.

A Delegate—In behalf of a delegate from down in Egypt, I would like to know of Mrs. Baker if she has any duplicates of these Manhattan hayseeds, and whether that continues in the other towns?

Mrs. Baker—I would say to the gentleman that there are plenty of them over in Manhattan,

The president announced an invitation from the Women's Federated Clubs and the ladies of Joliet to all out of town ladies to attend an informal reception at the Joliet Public Library, Wednesday afternoon.

And thereupon the meeting was adjourned until 1:30 p. m.

GENERAL SESSION, OPERA HOUSE—1:30 P. M., FEBRUARY 21.

At the session of the Illinois Farmers' Institute held in the Joliet opera house, Tuesday, Feb. 21, 1905, at 1:30 p. m., after music by the pupils of Roosevelt Grammar school, Chairman Wyman in introducing the speaker of the meeting, said:

Ladies and Gentlemen—Our next number will be by Professor Forbes, from the University of Illinois. His talk will be on Insects Injurious to Corn. When he gets through, you will find that there are a great many fields of corn through the State, and some of your own corn fields, where these insects have been at work, and you knew nothing about it.

PROFESSOR FORBES.

INSECTS INJURIOUS TO CORN.

MR. CHAIRMAN, LADIES AND GENTLEMEN—This is not to be a lecture. I am not to read a paper. I am not to make an address. We are to have a conversation upon the subject of the corn insects. This is not to be a monologue; I am not to do all the talking. In order to a conversation, there must be at least two parties. I will try to keep up my end of the conversation, but I shall have to look to the audience to keep up the other end by asking me questions—anything that occurs to you that you are interested in, upon the subject of the corn insects of Illinois, and means of controlling them.

In order, however, to a beginning, I propose to go back where we were when we were talking about this subject a year ago, at the State Farmers' Institute meeting in Decatur. When that meeting closed, or at least when my part of it closed, we were talking about the corn root-aphis; and I am going to make the rather bold assumption that those who were there and heard what I said remember it now substantially, and the still bolder assumption that those of you who were not there, and consequently did not hear what I said, have read the published matter in the State report. Consequently I am not going to rehearse, at the present time, all the facts concerning the corn root-aphis, unless you call for them by way of question after I tell you some things which we did not know at that time, and which I have found out since our last meeting. I shall be obliged, however, to say first one or two things in regard to the insect itself. I have it illustrated on a large scale here on this chart, faithful as to shapes and as to colors, drawn from life by an expert artist. (See colored plate.)

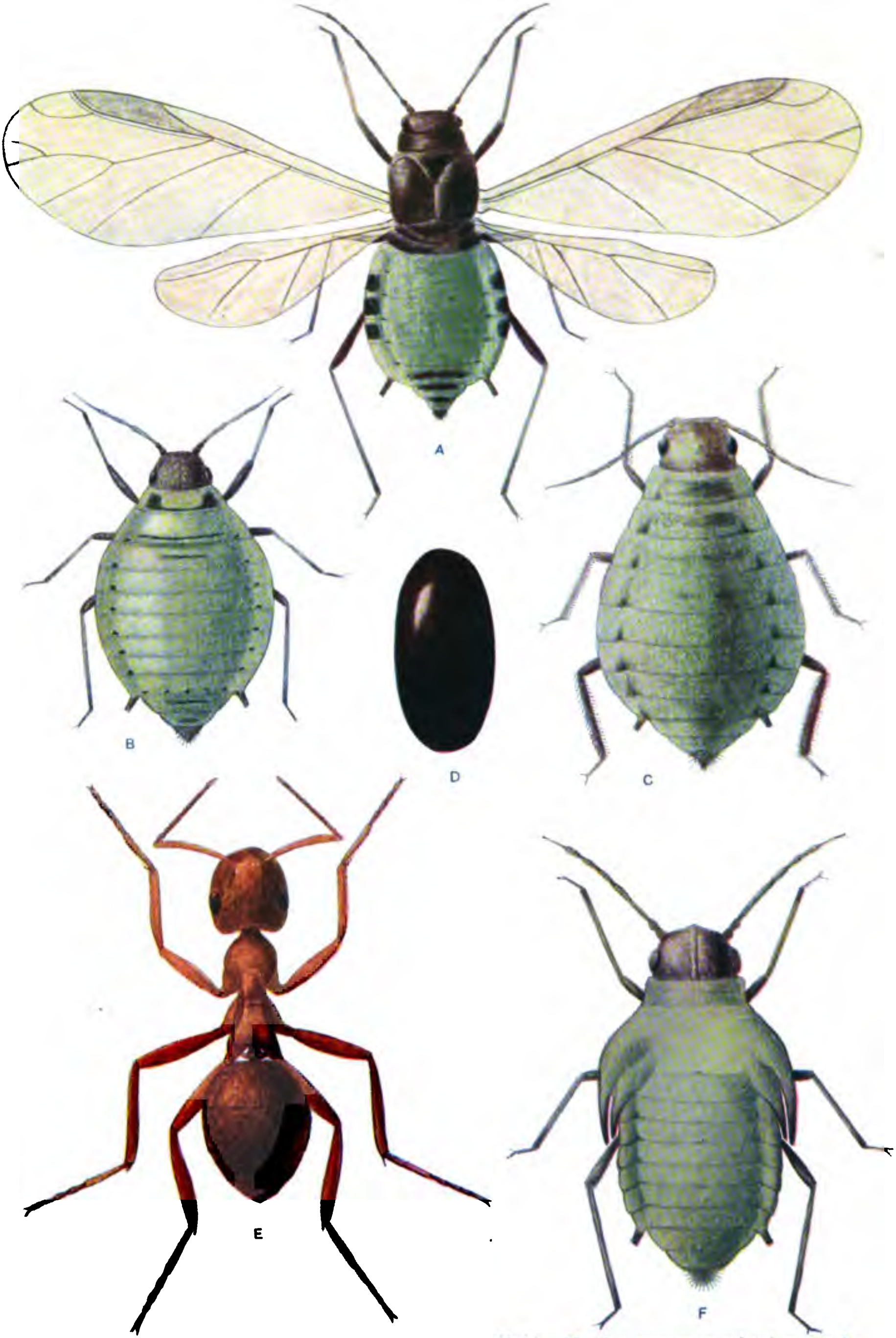
The object which I want to call your attention to first is this central one, a slender, egg-shaped body, smooth, jet-black, and shining. That is an enormously magnified representation of the form in which this insect is just now to be found in the old corn fields, and almost nowhere else. In these old corn fields it is only in the nests or underground burrows of small brown ants, (Fig. colored plate) which are passing the winter among the roots of the old corn hills. In those burrows are little chambers which have been excavated by these underground ants, and in those chambers they have piled up accumulations of these shining, jet-black eggs. These they are keeping over the winter as their chief treasures—next to their own eggs and young, which they also have in a similar situation in their underground nests. These aphis eggs the ants will take active charge of next spring, when the weather opens up and there is an opportunity for the eggs to hatch. The young lice which hatch from these eggs live at first in the old corn field upon smartweed, and a little later upon pigeon grass, upon the young plants as these sprout from the seed in the ground. They suck the sap from these plants, and live in that way until the ground is planted to some other crop. For our purposes, we must suppose that the crop is corn.

When the ground is planted to corn, the ants burrow along the roots of the corn, under ground, take the young lice from the roots of the smartweed and of the pigeon-grass, which by this time have become a little dry and hard and transfer them to the fresh, rapidly growing, succulent roots of the corn, and there the young root-lice, as we call them, proceed to feed, and there they stay and breed the season through, the ants at this time depending upon them wholly.

Now, if you will refer back to the account of last year, you will recollect that I told you that we had made some imperfect experiments, in an effort to scatter and destroy these eggs and young plant-lice as they hatched in the field in the spring, before and immediately after it was planted to corn. I told you that the results of such experiments as we had made were promising, but that we had not gone far enough to have anything very definite or positive to say upon that subject. Since then, however, I have made two experiments with this procedure, and I want to give you a brief account of those experiments, and the results of them, as an introduction to this whole subject, and,—please take note of this,—as an illustration of one of the moremodern methods of investigation in economic entomology.

In the old days, the economic entomologist was an entomologist merely. He went out and observed the insects, learned their life histories, their relations to crops and their injuries to the crop plants, and upon the basis of information thus brought together he made certain recommendations as a matter of inference from the facts which he knew. A little later, he began to experiment, in a small way in his office, or in his insectary, or in his laboratory. But in these days, the economic entomologist goes into the field and makes his experiments in the fields where the farmer must apply the results which he brings out; uses the apparatus and methods of the farmer himself; works his experiments on the large scale of actual practice, and thus brings out a result which can be immediately appropriated by the farmer, if it is a useful and promising one, and carried into actual practice without delay.

There is one other step, the next one to be taken, I think, in the development of economic entomology, and one that is as important as any. Having found out, by these experimental methods, by the actual operations of field practice, what can be done and how to do it, we propose to send agents out to demonstrate these methods, if they are matters of prime importance to agriculture, in the various parts of the State, so that here a community and there a community may see, by actual demonstration and explanation, what is done and how, and by subsequent observation may learn for themselves exactly what is the out-



The Corn Root-louse (*Aphis maidiradicis*). B, the common wingless and, **A**, the winged viviparous females; F, the pupa of the winged female; C, the oviparous female, occurring in autumn, and D, its egg; E, the root-louse ant (*Lasius niger*)

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come. This may be, and is coming to be, not a substitute for description and publication, but a great aid to description and publication and report. Some day we shall be doing that kind of thing in regard to the procedure in this particular case.

When I have given you this little account of my experiment, then you may ask any questions you like upon this whole subject of the corn root-aphis, and when we are done with that, we will take up anything else you choose.

What I undertook to do was—beginning somewhat early in the spring, before the ground had been planted—to have ground previously in corn and infested last year by this root-aphis, repeatedly stirred to a considerable depth, in order that the nests of the ants might be broken up and their contents scattered through the earth, where even such intelligent and active and persevering insects as the ants could scarcely find them or bring them together—and to have this done repeatedly enough so that any plant-lice hatching from the egg might be expected to starve to death, in the absence of weeds, and in the absence of the care of the ants, without which the plant-lice cannot find their way to the roots of the plants.

This is a point of special importance. We have determined by actual experiment, where we could observe all the facts, that if these young root-lice are left to themselves after hatching, although there may be an abundance of plants about them upon which they ordinarily feed and in which they would find an abundant sustenance, if there are no ants there they cannot find their way to these plants or help themselves to food. The assistance of the ants is essential to their maintenance—to their making a start in the first place; and consequently, if the ants lose possession of these winter treasures, and are not able to gather them up again, of course the root-lice, as they hatch from the eggs, must perish.

I had two experiments made; one in Knox county, near Galesburg, and another near Harvel, in Christian county, south of Springfield. In the Galesburg experiment, we had nine acres of corn which last year was badly infested by these root-lice; so much so as to diminish considerably the yield of the crop—at least so the owner judged. Three acres of these nine were set aside for our experimental use. The other six acres were treated as old corn ground to be planted again to corn would ordinarily be treated. For convenience, sake, I will call these six acres which received the ordinary treatment of corn culture the check plot, and call the three acres which received the experimental treatment the experimental plot, and then we shall understand each other.

This check plot of six acres was simply plowed early in May, planted between the thirteenth and seventeenth of that month, harrowed once, cultivated June 9, and on the 10th day of June we made our examination of the field, in order to bring the contents of this part of the field into comparison with the other. The experimenal plot of three acres, on the other hand, was plowed May 14 to 16, was disked three times in succession, on the 18th, 21st and 25th, was harrowed May 25, was planted that same day, was cultivated on the 28th day of May, and harrowed on the 30th. The only difference in the treatment of these two plots was in the three times disking and once harrowing of the experimental plot.

Now, going to this field and making a careful examination of a large number of selected hills in the two parts of the field, we found, on the 10th day of June, that 28 per cent of the hills in the check part of the field were infested with ants, and that 10 per cent of the hills on the experimental side were infested with ants; that 17 per cent of the hills on the check side, which had received the ordinary treatment of the corn farmer, contained plant-lice, and that on the experimental side, 3 per cent of the hills contained plant-lice; that on the check side 100 hills contained 2,263 ants—they were all caught and counted,—and that on the experimental side 100 hills contained 185 ants, 2,263 of the insects themselves, as compared with 185; that on the check side, 100 hills contained 858 plant-lice, and on the experimental side 100 hills contained seventy-nine plant-lice. Or, stating the whole result of the experiment in a single sentence, there were twelve times as many ants in the corn hills in the check part of the field as there were in the corn hills in the experimental part of the field, and eleven times as many plant-lice on the check part of the field as there were on the experimental part. That was the outcome of that experiment.

The other experiment was a little different, although substantially of the same character. Without taking time for particulars of the treatment, I will only say that here again a larger field was divided into a check part and an experimental part; that the check part of the field was spaded and harrowed June 1, planted June 2, harrowed again June 13, and examined immediately after; that the experimental part was harrowed May 25, spaded May 26, spaded again June 1, planted June 2, rolled June 11, and harrowed June 12 and 13. There was not nearly as much difference in the treatment of the two sides of the field here as there was in the Galesburg field. The only difference here between the two parts of the field was that the experimental field was spaded once June 1, and rolled once June 11, and neither of these operations was performed upon the other; a very slight difference in treatment as you will see.

Examining this field June 14, we found that 62 per cent of the hills on the check side contained ants,—nearly two-thirds of them. It was a badly infested field. On the experimental plot 25 per cent of the hills contained ants. We found that on the check side 44 per cent of the hills contained plant-lice, and on the experimental side 11 per cent of the hills contained plant lice; that on the check side, 100 hills contained 1,961 ants, and on the other side 100 hills contained 630 ants; that on the check side 100 hills contained 1,464 lice, and on the experimental side 100 hills contained 198 plant-lice. So in general terms, this simple treatment, which amounted to scarcely more than once harrowing, had the effect to reduce the ants in the field to one-third and the plant-lice in the field to one-seventh of the number it would otherwise have contained. That is my part of the subject. Have you any questions to ask?

A Delegate—You spoke of the ants being necessary to the aphis. What does the ant get out of the aphis?

Professor Forbes—The ant gets out of the aphis its living. It is not strictly and necessarily dependent upon plant-lice, but the easiest way it knows of to get a living, is to take care of the plant-lice and feed upon the fluids which they exude. If there are no plant-lice about, the ant can help itself. I have seen this species of ant capturing living insects in the field and dragging them off to its burrows. It gives them a bite or a sting, apparently, and they become helpless, and stiffen out seemingly dead; and the ant drags them away, like a bit of wood, down into the burrow, and there, doubtless proceeds to feed upon them. But that is a laborious operation. All plant-lice are great feeders. They are practically living automatic pumps. They sink their beaks into the tissues of a living plant, and proceed to pump out the sap. They swallow a great deal more food than they need, and give it out in condition to nourish other insects; and ants have learned to avail themselves of this surplus food, and have learned to take care of the plant-lice as interesting and important to them. That is their motive in doing it.

Mr. Heun—Do we need to fear the plant-lice after anything but corn?

Professor Forbes—There was a question asked down here.

Mr. Williams—Does the aphis destroy in any way the oat crop following?

Professor Forbes—The question is asked down here, if the aphis affects in any way the oat crop following, if an infested corn field is planted to oats. This corn root-aphis does not live upon the roots of oats.

If oats are sown on an infested field, the aphis will live in that field for a considerable time, but it will live on the roots of the weeds which spring up among the oats. And where the roots of the smartweed and the roots of an oat plant grow together and are intertwined in the ground, the root-lice there will be found on the roots of the smartweed but not on the roots of the oats. Consequently an oat crop is not liable to any injury if it follows corn.

Mr. Heun—That answer throws a little light on my question. My question was, do we need to fear the aphis to any practical extent, after any crop but corn?

Professor Forbes—That question is a very important one and it takes me a little further into the life history of the corn root-aphis. The question asked is, in other words, if corn is grown on some other ground than corn ground, may it be injured by the root-aphis. This insect is peculiar in the fact that there are a series of generations produced in a single season. Eleven days, on an average, is sufficient, starting with the young, just born, to make a completely developed root-aphis out of it, itself competent to bring forth young. In the early part of the season it takes fourteen to fifteen days; in the middle of the season when the weather is favorable to rapid insect growth and development, from seven to nine days is sufficient. In a single week one of these little creatures may grow up and be itself bringing forth young. There are, consequently, a large number of generations in a single season.

Now, beginning with the third of these generations, beginning even with the second of these generations, some of them get wings, (Fig. —) although, as ordinarily seen on the roots of the plant, they are wingless and almost helpless. Some of them, however, after the second generation, begin to get wings—a certain variable percentage of them. These winged ones come out of the ground and fly abroad and settle wherever chance takes them. They have no intelligence; no power of direction. Those of them which settle in corn fields, no matter what kind of ground that corn was planted on, are taken possession of by the ants in those fields and carried under ground and placed upon the roots of the corn. Developing at the rate at which these insects are capable of multiplying, these scattering winged insects thus spread indefinitely over the country are capable of infesting corn fields later in the season, even though those fields may not have been in corn the previous year and are consequently not growing on ground infested by these insects the previous year. Only the first generation is confined to ground which was in corn the previous year. The rate of multiplication is such consequently, that, along by the middle or the latter part of July, a field which was not in corn last year may become so heavily infested by them that the effect of their drain upon the roots of the plants shows in the condition of the crop. I think that answers the question.

Mr. Frake—Let me ask if, after your corn crop, the corn stalks are cut off and the ground is plowed in the fall, if that tends to kill this aphis or the eggs?

Professor Forbes—I have found that if this is done too early in the season the ants will reconstruct their burrows and will gather up their eggs and their own young and do fairly well. If, on the other hand, this is done after the ants in the ground have become somewhat stupid with the cold, then it has the effect to confuse and scatter them and thus to prevent their gathering up the plant-louse eggs and so diminishes the numbers of the lice. There is no doubt that fall plowing, the later the better, will help in this way.

Mr. Raymond—I would like to ask the result of the crop that was raised on the experimental ground and on the check ground?

Professor Forbes—I regret very much to say that I am not able to answer that question. I wanted particularly to send some one back to those fields, but when the time came my office force, small as it is, was completely engrossed in other ways, and I simply could not pull them off from the things they were doing then and send them down. I may say that this whole matter is reported to you as a statement of progress and not as a finished experiment. We shall take it up again next season, if we have an opportunity and men and money to do it, and work it out. I cannot tell you what the result was as to the crop. I hope, although I do not know, that the effect of that treatment of the corn ground was evident in the increased value of the crop and that such an operation as that would be profitable, even if there were no plant-lice in the field.

Mr. Frake—Let me ask, are there any other insects destructive to corn in spring that will be destroyed by late fall plowing?

Professor Forbes—Well, if you had said early fall plowing, I should have answered you, "Yes." Where grass is plowed as a preparation for the growing of corn, fall plowing is preferable to spring plowing. That is a general, invariable rule. But an early fall plowing is preferable to a late fall plowing, and the earlier the better, for reasons that I could explain at length if I were to enter into a full account of some of the other insects injurious to corn. The one, perhaps, that is the most unfavorably affected by an early fall plowing is the cutworm; and perhaps right here I can not do better than to take up that subject very briefly.

Delegate—Have you finished up this matter of the corn root-aphis? I would like a single question there. To what extent is it probable that that insect is injuring our corn, in northern Illinois?

Professor Forbes—I am not able to say to what extent. I may say, however, that during the last two years, more inquiries have been addressed to me by farmers concerning methods of control of the corn root-aphis, methods of preventing injury by it to corn, than about any other insect in the corn field. I do not think that any other three insects by which corn is attacked, are, at this present time, attracting so much attention by observant farmers as the corn root-aphis. They report to me all sorts and grades of injury, from those insignificant, so far as the farmer himself notices, to a complete destruction of the crop. The truth is, however, that the ordinary observer of affairs in the corn field does not realize the amount of injury done by this insect, because he does not recognize in detail its effects. Sometimes, where the season is entirely favorable to the growth of the corn plant, particularly where the weather is moist, so that the plant grows freely, it will rally, even though it may have been heavily infested when it was a young plant, and apparently outgrow the injuries of this aphis. If, on the other hand, the season is unfavorable, all sorts of consequences unfavorable to the yield of the field may follow an early infestation. The plant may be killed outright. It may never appear above ground, and the farmer may suppose that his seed is at fault.

It is curious, the intelligence and the perseverance with which the ants will search out the sprouting corn in the earth. I have seen hills infested by ants and plant-lice before the sprouting plant had appeared above the surface; blue with them, in fact. The ants, in their active explorations, have discovered these sprouting plants, and have made their burrows, and transferred the plant-lice to the plant while it was still underground.

The plant may grow freely enough, but remain a bastard stalk. Or it may grow and mature an ear, but the ear be dwarfed; all sorts of injuries of that description may ensue. In some cases those who have observed and written to me for information say that the loss of the crop was about 25 per cent. Others say that, compared with their neighbors' fields, or other fields of their own not infested, the loss was 50 per cent. It is a very serious matter, and a particularly threatening matter owing to the enormous rate of the multiplication of these insects, and the fact that they are mainly dependent upon corn for their food

A Delegate—A young man near me asks for a description of the insect, particularly as regards its size, so that he may recognize it.

Professor Forbes—They are not as large as the head of a pin. Perhaps the head of a very small pin will be a sufficient description as to size, for our purposes. You never need fail to find them in the corn field in the early spring, for the reason that wherever you see ants mining in a hill of corn, making their burrows and bringing the earth to the surface, there, if you dig, you will almost certainly find these root-lice, or, if they are not there then, they will probably be there a little later. The ants will frequently mine corn hills at a time when they have not any root-lice in their possession, and as fast as they get possession of them, they take them down into their burrows and start them on the corn.

Mr. Buckner—I want to know whether or not certain kinds of soil, for example, swampy land or wet soil, are more infested by these aphides than other kinds of soil?

Professor Forbes—We have never, in the fifteen or twenty years during which we have observed these insects, noticed any difference of that description.

Mr. Dobson—Are there any natural causes that destroy these insects, such as rains, or heat, or moisture, or drouth?

Professor Forbes—I don't know of any.

Mr. Wilson—In regard to the question that was asked over here in regard to the injurious effect. Now, if the injury from this source amounted to 25 per cent of the corn crop the first year, what would be the result the second and third, continuously?

Professor Forbes—It depends very largely upon the season. Of course it increases. But we really have not continuous observations, year after year, in the same field, of a character to enable us to answer that question accurately.

A Delegate—A question I would like to ask is, is it practical to follow corn with corn, if it is infested with this root-aphis?

Professor Forbes—It is better not to.

A Delegate—Is it absolutely necessary not to?

Professor Forbes—No, it is not absolutely necessary not to; because such a treatment as I have described here will have the effect to reduce the number of plant-lice in the field.

A Delegate—Rotation would be advisable, then, if it is not absolutely necessary?

Professor Forbes—It is not advisable to follow corn with corn where the crop has been injured by these plant-lice the preceding year.

Mr. Lee—Does that insect have any tendency to make these barren stalks? Among the fields of northern Illinois, there were more barren stalks in the corn fields this year than I ever saw before. It was a cold, wet year. Now, does that insect have any tendency to make those barren stalks?

Professor Forbes—We have found that anything—no, I will not say anything; that is too large a statement; but that several things that have the effect to reduce the vitality of the young plant, injuries which weaken it when it is young, have the effect to increase the number of barren stalks in the field. It seems not to be any one thing, but there are certainly several causes of that condition; just how many I do not know. But a little later, if we get to that, I propose to describe to you the effect of an injury by the corn bill-bug; an injury very different from this, which does exhibit itself in part in an increase in the percentage of barren stalks in the field.

A Delegate—I would like to ask the professor how long these insects work?

Professor Forbes—These insects continue to breed on the corn through the whole season. On the other hand, when the plant gets its start, gets considerable size, and begins to grow vigorously, the amount of sap which they take away from it is insignificant in its effect. The damage is almost all done when the plant is small. They last upon the roots, but do not do any particular harm after that.

A Delegate—Stirring the ground would be detrimental to this aphis, and thorough work when the corn is small?

Professor Forbes—Yes; the more continuously you stir the ground when the corn is small, the less likely you are to have a serious injury by these root-lice. On the other hand, you must remember that at that season of the year the root-lice are all on the corn, and you can not get rid of the lice by stirring the ground. They are on the roots of the corn, and you can scatter them somewhat, and confuse and scatter the ants, but you can not get rid of them by anything done after the corn is planted. You must depend for that upon a treatment such as I have described, before the corn is put into the ground.

Mr. Goebel—Are these ants of any certain species, or are *any* ants useful for the aid of these insects?

Professor Forbes—We have had about four species of ants in attendance upon these plant-lice in the field. But 99 per cent of the ants in attendance upon this corn root-aphis are all of one species. It is the common small brown ant of the corn field and the pastures and meadows. Everybody must have noticed at certain seasons of the year, particularly in early spring, the multitudes of little ant burrows which are made in the grass lands, beside and in a path through the grass. That is the work of this same ant. It makes these burrows among the roots of the grass, and maintains there another species of root-louse, the grass-root louse, to which it stands in the same relations as it does to this corn root-aphis. It is the commonest small outdoor ant; and if you know any outdoor ant at all, to be found in the pastures and corn fields, you know this one.

A Delegate—What is the best way to destroy these ant nests?

Professor Forbes—There is no practical way that I know of, except to plow them up, and scatter the contents.

Mr. Easterly—How deep does the ant burrow with the corn root-aphis? Or, in other words, how deep do we have to cultivate, in order to molest them?

Professor Forbes—That is a very important question. In an ordinary plowing of an infested corn field, you will get pretty nearly everything in the way of ants' nests and burrows, and things stored up there. Occasionally you will find that, in the bottom of the furrow, you will have simply laid open a chamber of one of the ants' nests without actually plowing it up and scattering its contents. Four inches is about the maximum depth to which they ordinarily go in making their burrows.

The Chairman—What influence, if any, does the action of those ants on the corn roots have, or what did it have this last year, towards causing the corn roots to be so weak? A great deal of the corn all over the State fell down, this year, and did not straighten up. Did the action of those lice have any part in causing that?

Professor Forbes—I suppose you have all heard this question of your chairman?

A Voice—Not a word of it.

Professor Forbes—I think when I answer the question, you will see what it was. I don't believe that the mere abstraction of the sap from the roots of a young corn plant will so weaken the root that the cornstalk is liable to fall when it grows up. You have got to destroy the root, in order to do that. When you abstract the sap, you simply reduce the general vitality of the plant, and not the vitality of any particular part of it. When an insect devours the root, as the white grubs and the corn root-worm do, then the root is affected more than any other part of the plant, and the hold of the plant upon the ground is weakened. I do not think that the falling of the corn this year was due to injuries by the corn root aphis.

Mr. Mullens—In the late plowing of sod, plowing under a good coat of grass, clover or timothy, wouldn't you think that those insects would feed on those roots until the corn got started?

Professor Forbes—This corn root-aphis is never found on the roots of the pasture or meadow grasses, and consequently a sod is not liable to be infested. The corn root-aphis is to be found at first only in ground that was in corn the preceding year.

A Delegate—What is the color of the insect?

Professor Forbes—Just the color of the picture you see on the chart here. Pale bluish green.

A Delegate—Is this bug not a blessing in disguise?

Professor Forbes—Well, I have not been able to see through the disguise yet, if it is. (Laughter.)

A Delegate—Aren't they a blessing, by compelling a rotation of crops?

Professor Forbes—I did not think of it in that connection, because there are other insects which compel a rotation of crops more emphatically than does the corn root-aphis. The corn root-worm is one of them. Possibly we shall get to that after a time.

Mr. Wheeler—Did I understand you to say that this did not destroy the root of the corn, so that it would die?

Professor Forbes—No, I do not think that the corn root-aphis ever kills the root. It simply sucks away the sap. and the effect of that is to weaken the entire plant. It makes only a microscopic wound in the root.

Mr. Wheeler—It won't destroy the corn absolutely?

Professor Forbes—It does sometimes kill the corn absolutely.

Mr. Wheeler—Then the root is dead, ain't it?

Professor Forbes—Yes. I thought you meant does it destroy the root primarily. It destroys the corn absolutely, in very dry seasons, because, as you will see, a mere abstraction of the sap from the plant has virtually the same effect as drought. To take the sap out of the plant is virtually the same in its effect upon the plant as to diminish the water supply, or to prevent the formation of the sap. So the effect of the corn root-aphis is as general upon the plant as a whole as the effect of drought is.

A Delegate—Will the ants themselves do any damage to the corn, or is it all done by the lice?

Professor Forbes—The ant itself is incapable of damaging the corn. Its method of feeding and its feeding structures make it incapable of eating anything except fluid or semi-fluid food, and it has no means of getting at the fluid sap of the corn plant, except by the aid of some other insect.*

Mr. Lutz—This fall I discovered a green bug on the ear after it formed. What is that? It ate quite a bit of the ear off—about an inch or so, where it was bare of husks, and stood quite a little frost. It was perfectly grass-green all over.

Professor Forbes—It is a notice to put that ground in some other crop than corn next year; the most emphatic notice you could have.

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*Ants sometimes hollow out the softened seed kernel in the earth after it has sprouted, thus depriving the young plant of a part of the food which has been stored up for it in the grain, with the effect to starve and dwarf it, at least temporarily.—S. A. F.

A Delegate—What would be the result if the soil contained no vegetable matter whatever for the aphis to subsist on till the corn germinates?

Professor Forbes—There couldn't be any aphis there for the reason that by the time the corn is planted at least the second generation of this insect, and sometimes the third generation, has come into being, the first generation having, in the mean time, all perished. Now, if there is nothing for the insect to feed upon during the life period of its first two generations, of course they will all starve to death, and there won't be any subsequent generations.

The Chairman—We would like to hear in regard to the green bug on the ear.

Professor Forbes—That carries me to another subject, and a very important one. It seems to me this insect must be generally pretty well known by this time, but nevertheless the facts are worth repeating. The insect to which Mr. Lutz's question refers is known as the corn root-worm. It is illustrated by these various figures here. (Plate.) His question related to this grass green beetle, which is correctly shown here as to form and color and general appearance, but of course magnified immensely as to size. The actual size of the beetle is not far from that of a common red, black spotted lady-bug. It is quite different in shape, but of approximately the same size. You are most likely to find this beetle in fields which have been in corn for two or three or more years, and you are most likely to notice it when it is at the tip of the ear, eating away the silk, or if the kernels at the tip of the ear have been injured by birds or in any other way, feeding upon the kernel at the exposed end of the ear. Later in the season you are very likely to notice this beetle on thistles outside the corn field, or on the blossoms of ragweed within the field, or sometimes on heads of clover; always on the blossoms of plants. This insect is born only in corn fields. It comes up out of the ground in August and September, being at first yellowish in color but gradually changing, with exposure, to a bright grass-green. It makes its first food of the pollen which sifts down out of the tassel of the corn, and collects at the angle between the leaf of the corn and the stalk. Then it climbs up and gets on the silk at the tip of the ear and gnaws that away, and thus prevents, to some extent, the fertilization of the ear, and later, as it gets its powers of locomotion, it generally scatters and helps itself to whatever it can find.

This beetle has relatively weak jaws. It is unable to feed upon anything so hard and stiff as a corn leaf. It is thus limited for food to the delicate vegetable tissues which it can find at that season of the year, and is found almost wholly upon flowers of various plants. If it is very numerous in a field it is likely to scatter out of the corn field, and may then be found on flowers and on other vegetation of a delicate character throughout the neighborhood. In fall, in October and in November, the female of this beetle lays her eggs in the ground, and, so far as we have ever been able to find out, only in old corn fields. That seems very curious, but we have never been able to find this beetle laying eggs anywhere except in fields in corn that year. I don't know whether the beetles go back into the corn fields after having left them in search of food or not; but we have made most persistent search in all kinds of situations where we might suppose the beetles were laying their eggs, and have never found them laying eggs anywhere else.

The eggs are laid by this corn root beetle in the ground, from one to four or five inches under the surface. The beetle does not burrow down, but simply avails herself of cracks and crevices in the ground to go down as far as she can without actually digging. The eggs are of the shape and general appearance shown here (Fig. 228); just about the shape of a hen's egg, but of course almost microscopic in size. They are not placed anywhere in particular, or surrounded by anything in particular, but simply dropped in the dirt, one here and one there. We had a long hunt for those little things before wefound them. When we did find them we were not absolutely certain that they were the eggs of this beetle until we dissected the female beetle, took the eggs from her ovaries, and by comparison and measurement identified hem in tthat way.

These eggs last over winter in the old corn fields and are not known to occur anywhere else. In the spring they hatch out small maggot-like grubs (Fig. 226), slender, white, and with six very short, scarcely visible legs just behind the head; the head itself hard and brown, and a brown patch on the top of the body, just behind the head; a circular brown patch on the upper part of the hind end of the body, the rest of the body being soft and wrinkled, very much like that of a white grub. It is not as thick as a small pin, and it is about a quarter to a half an inch in length when full grown. You will probably never see one of these corn root-worms—that is the name given to these larvæ or grubs—unless you split a corn root open and happen upon one which is infested by these larvæ. It lives entirely inside the root, and consequently its work is very little understood, and the root-worm itself is very rarely seen. This part of the figure here is an illustration of its position (Fig. 229). This is an infested root which has been split open, and in the center of it you will see the larva in place, and you will notice that behind it here is a wavy brown track. That is the channel or burrow which it has made in eating lengthwise through the root. The usual effect of this injury, beginning as it does when the corn plant is small and lasting through the whole season until August and September, and in part on into October before the transformations of the root-worm are all completed, the usual result of this burrowing of the corn root is to cause the root to die as fast as it is burrowed. This injury can be distinguished, however, from an actual eating up of the root by the fact that a root which has died in this way has simply shriveled and withered at the tip, instead of being bitten off as where the white grub has done the damage. A root which is in that condition, if split lengthwise, will ordinarily show the corn root-worm inside.

Now, beginning sometimes late in July and on into August, but particularly in September, these corn root-worms having got their full growth come out of the root, and there in the dirt among the corn roots in the hill they change into this form or stage, known as the pupa stage (Fig. 225), corresponding to the chrysalis stage of a caterpillar. There in that form they last a week or two and then transform, still underground, into this form, this beetle stage (Fig. —), which comes up out of the ground and feeds upon the pollen and silk at the tip of the ear and so on, as I have described. There is, as you will see, but one generation of these corn root worms in a year; and you will notice, also, that the winter is passed always in the egg stage, the old beetles which have laid the eggs perishing in the fall, none of them wintering over.

This is rather a long story for the very brief conclusion to be drawn from it, which is, that a complete check to multiplication and an entire preventive of injuries by this most destructive insect is afforded by a mere change of the crop. Wherever corn has fallen in considerable quantity, where the roots exhibits the appearance which I have described and where the root-worms can be found by splitting open the roots, but particularly and more conspicuously, much more easily told, where these grass-green beetles are seen at the proper season in unusual numbers on the silks at the tip of the ear, there you may be sure that corn should not be raised the next year. The beetles will lay their eggs in that ground and the eggs will hatch in the spring. The young larvæ feed upon nothing except the roots of corn. I think we may safely say that. We have searched so long and so far, and have examined so many other different plants without ever finding any trace of injury by these larvæ to anything else, that I think we may safely say that with us, at any rate, the larvæ feed only on the roots of corn. And consequently, if that ground, containing the eggs in spring, is planted to some other crop, the young as they hatch simply starve to death, and that is the end of the whole matter.

A Delegate—Is that a winged beetle?

Professor Forbes—Yes; it flies freely.

Mr. Buckner—I would like to have you take up the grub or insect that eats into the end of the ear and changes the ear into dust.

Professor Forbes—That is the ear-worm, or corn worm. It is hardly worth while for me to take it up for I cannot help you. I have the insect here on the chart (Fig. 220) and I will show it, but I shall not be able to give any advice that will be of much importance.

It mines around under the husk and destroys the kernel. The caterpillars are variable in color: some are almost a uniform green; others are striped brown. When this caterpillar gets its growth it goes into the ground, and about an inch to an inch and a half under the surface it forms an earthen cell, and there it changes into its chrysalis (Fig. *d*). It lasts over the winter in that place and condition. The following spring it comes out a moth, like that picture (Fig. *c*.*f*.) and that moth lays this kind of eggs here (Fig. *a*. *b*.). There are three generations of this insect in a single season in our latitude. The only suggestion, even of a preventive measure, is to cut the corn in the fall, plow the ground to break up these chambers in which the ear-worm is passing the winter in its dormant, pupa stage, and thus prevent its coming out the following spring as a moth. That this treatment will have that effect has been demonstrated in a small way in the laboratory only. But, on the other hand, you will see that that is locking the stable after the horse has been stolen. It is destroying the insect after it has done its injury and lived its life through. If everybody would do it there would not be as many corn root-worms in the country the following year, but for one man only to do it does not make much impression on the population and he is just as likely to be injured the following year as before.

This insect has received very extensive study; not because of its injuries to corn. It is very much better known as the cotton boll-worm. It is the same insect that devours the cotton boll in the southern states. And it has been worked on for years by the United States Department of Agriculture in the hope of destroying it as a cotton enemy. The only thing that has been found successful down there is to poison the cotton plant with Paris green or some such preparation at the season when these larvæ are feeding upon the bolls. That is not practicable in the corn field because the poison would not reach the place of mischief and it would be too expensive.

Delegate—Is that any relation to the army-worm?

Professor Forbes—No, it is different from the army-worm although its resemblance is such that I have repeatedly had it sent to me by farmers with the inquiry if it was not an army-worm. For one thing, you never see an army-worm injurious at that time of the year. The army-worm is injurious earlier in the season. And you will never find an army-worm under the corn husk in an ear. Any caterpillar found in that situation is virtually certain to be this so-called ear-worm.

Mr. Brehm—Is that the insect that is so destructive to corn in the southern states?

Professor Forbes—Yes, the same one; and to sweet corn everywhere.

A Delegate—Isn't it becoming less numerous in this locality, as the time passes further from the prairie sod condition?

Professor Forbes—I cannot say about that. I should think it is rather a growing than a diminishing pest in the southern part of the State. There is, in fact, a third generation down there, which continues to work on the ripened ear, so that after the corn has been cut and shocked, the ears are still injured by these caterpillars. I have often found the ground peppered, beneath a corn shock, by the excrement of these corn worms.

Mr. Kerry—What effect has the killing of the crows on the corn crop?

Professor Forbes—That takes us a little outside of the entomology of the corn field, for the reason that the crows are not enemies of the corn insects, generally speaking. If you want a simple statement with regard to the crow, the United States Department of Agriculture has worked out the crow pretty thoroughly, and as I remember their conclusions, based upon a careful analysis of the contents of many hundred of stomachs of crows, shot at all seasons of the year and in all parts of the country, they give just about a neutral verdict. The crow is just about as harmful as it is beneficial, and as beneficial as it is harmful. If he gets in your way, it is your privilege to kill him. If he is doing damage, kill him, but otherwise let him alone, is the outcome.

A Delegate—Three years ago, I planted a field of corn. I had raised three crops of corn previous to that. It was an old blue-grass pasture sod, and part of it was rather high ground, and it ran down to low ground. And all across the high ground, I noticed that something had taken the corn. On examination, there was a little worm, in the neighborhood of an inch or an inch and a quarter in length, very slender, not much larger than a pin, a kind of a brownish color, that worked itself all up into a little ball, and sometimes getting inside the kernel it worked the sprouts all out. It had completely destroyed the corn. On the low land it had not bothered the corn at all. I had to replant. I simply ran the planter through the old marks and planted in, and they did not bother the second planting. What kind of a worm was that?

Professor Forbes—Was it at all like that picture (Fig. 442)?

Delegate—Yes, sir.

Professor Forbes—That is what is known as the wire-worm.

Delegate—I think, though, that this one had legs the whole length of it.

Professor Forbes—That is a different thing. It is known as the thousand-legs.

Delegate—They were of a brownish color.

Professor Forbes—There is a great variety of them.

Delegate—Mine were a light brown; something like the wire-worms.

Professor Forbes—I can't talk about that, because I don't know really what you refer to. It may be a new thing. I wish you had written me. I wish everybody would, when they find something that they don't know about, write me, and send me one of them at least by mail. If I know about it, I will tell you by the next mail. And if I don't know about it, I will come there, or send somebody, just as quick as we can get there. Those inquiries by farmers are our great opportunities, and you have no idea how we value them. We write a great many hundreds and thousands of letters that do not mean anything to us (but that we hope will mean something to those that receive them), largely for the sake of the occasional letter that gives us a new clue, either to a new insect injury or to a new method of control. I have a little illustration of that just now. A few farmers have lately said that if they soak their seed-corn in turpentine the plant will not be injured by corn root-aphis that spring. I don't believe that, but I cannot prove that it is not so, and I am going to see whether it is or not. It may be that by mere crude experiment somebody has hit upon a valuable point. It is not impossible that the odor of the turpentine in the earth from the soaked kernel may last long enough, and have a sufficiently repellant effect upon the ants and the plant-lice to drive them away.

A Delegate—Isn't that liable to kill the germ?

Professor Forbes—There again, I dont know. Several farmers, in several parts of the State, have said it has the effect I have described. I don't believe their observations have been made carefully enough to give us a ground for an opinion, but I am going to find out.

A Delegate—That little worm we used to call the thousand-legs, and it will get right around the end of the kernel, on the small end of an ear of corn, and it will eat everything off. If you touch it, it will roll into a little ball It is about an eighth of an inch wide, and about an inch and a quarter long. I have frequently seen those little worms almost destroy a corn crop.

Professor Forbes—Eating young plants?

Delegate—Yes, sir.

Mr. Gorham—I have seen corn treated that way, with turpentine, two different years—on slough land, soaking seed-corn in turpentine—and it failed to grow. It was good seed.

A Delegate—The turpentine killed the corn?

Mr. Gorham—No, sir. The treatment failed to kill the insect that he is speaking of. The plant grew, but it was a failure as a corn crop. I would like to ask the gentleman what bird it is that is the natural enemy of this wireworm, if any, and also of the worm that gets into the end of the ear, that you have just spoken of.

Professor Forbes—I don't know of any bird or birds that destroy enough of the wireworm, in any of its stages, or of the corn ear-worm in any of its stages, to be of any particular value. The only stage in which the wireworm could possibly be destroyed by a bird would be the beetle stage, as illustrated here. I have seen the fragments of the parent beetle of the wireworm in the stomachs of birds quite frequently, but not commonly enough to amount to much. The insect is largely nocturnal, and birds are not generally abroad at that time of the day. The wireworm itself is subterranean, and of course birds could not get it.

Mr. Gorman—What is its natural enemy?

Professor Forbes—It hasn't any, that I know of.

A Delegate—With your permission, I want to say that we set up a lot of ears of corn alongside of a fence, that had some of those wireworms on them, and the sparrows came along and ate them up just as fast as they could get to them. I don't want to say anything for the sparrow, because it is destructive; but at the same time it will get rid of the wireworms.

Professor Forbes—Let us be sure that we are both talking about the same thing. What is properly called the wireworm is not the thousand-legs.

Delegate—I mean the thousand legs. I don't care what you call it.

Professor Forbes—My remarks applied to the wireworm, and not to the thousand-legs. Those thousand-legs are all very much eaten by birds. All birds that hunt around on the ground are very likely to get thousand-legs; all sorts of scratching ground birds.

A Delegate—It has been my observation that the wireworm works most where the ground is low and damp and sour, and I would like to know if there is any treatment of the soil by which we could retard their work, or destroy them.

Professor Forbes—Now let's make sure that we are all talking about the same thing. That term wireworm is very generally applied, as it has been here today, to two very different things; one this sort of a creature (Fig. 442), which lives only under ground, and the other the thousand-legs, which has been spoken of by two or three here. Is this the picture of the kind of an insect you have in mind?

Delegate—Yes, sir.

Professor Forbes—This is more properly called the wireworm. There has to be some standard of agreement with regard to the use of these common names; and the term wire worm means this sort of an insect or larva. It is cylindrical, and hard, and smooth, and shining, and slippery, and without legs, except three pairs of short legs just behind the head. It is from half an inch to three quarters of an inch, or possibly, in unusual cases, an inch in length. It is found, as I said, only under ground. You pick them up, and they exhibit a surprising strength and agility in getting away. They will slip out of your fingers while you are trying to hold them. They are the larvæ or young of this brown beetle (Fig. 439) that I think everybody will recognize. That is the common snapping bug, or skipjack, that everybody has seen and played with; that beetle which, laid on its back, gives a flip or snap and flies up in the air, and usually comes down right side up. The wireworm is typically and almost solely a grass insect. These beetles lay their eggs almost wholly in the grass lands. You will readily see, consequently, that corn following upon grass is particularly liable to be injured. Corn is never injured by the wireworm except for the first or second year, and very rarely the third year, after grass. The reason why the injury extends over that period of time is that this is one of the species of insects which requires two and sometimes three years to complete the life of a generation. It is like the white grub in that respect. Some insects, like the corn root-louse, lives through eight or ten or twelve generations in a single year. Some, like the army-worm, have three generations in a year. The great majority have but a single one. The wireworm requires three years, and, some say, in respect to some species of these insects, four years to complete its life history. The first year after sod there is plenty of food in the ground for the wireworms, and they are not likely, consequently, to injure corn seriously. But the second year after corn, the grass is dead, the roots are rotted, and there is nothing for the larva to feed upon except the corn plant. It consequently concentrates in the hills of corn, so that all the wireworms in the field will be found only in the corn hills. It begins to feed upon the kernel almost as soon as the corn is planted, and one digging into an infested field then will often see the kernels perforforated, with a wireworm sticking through at both ends. Later, it feeds upon the roots.

A Delegate—Tell us something about the cutworm; whether we should plow the grass land late or early.

Professor Forbes—I will, in a minute. Still later, this wireworm burrows the underground part of the stalk, and so often kills the entire plant. There is virtually nothing which can be done to prevent injury to corn by these wireworms after the corn is planted. If there were any way in which you could substitute some other crop following upon grass, for two years, before you planted corn, that would get the wireworms out of the way. The best thing you can do, is not to allow your pastures and meadows to run in grass any longer than necessary, because the longer they remain in grass the more these wireworms accumulate there, and consequently the more serious is the injury to the grass itself in the first place, and later to corn following the grass.

If you adopt Dr. Hopkins's standard rotation as he described it to me last evening, you will not keep your ground in grass more than two years. He says that it is too hard on the ground. He would sow clover and timothy together; let them grow together until the clover has done its best, and then plow them up and plant the ground to corn. Where any such procedure as that is followed, these wireworms do not become abundant enough in the sod to do any damage, either to the sod itself or to the corn following. And that is about all you can do. Dr. Hopkins is here, over in the corner, and if I have not given that correctly I wish he would speak for himself.

Dr. Hopkins—I think that is right. My thought is, clover, being a two-year plant, will grow two years in the timothy, and the third year you will have but little clover left. Then the timothy simply uses up the nutriment in the soil, and the longer it stands the worse it is for the soil and for the corn crop which follows. I know there is a great temptation for people, when they get a good stand of timothy, to leave it as long as it will stand on the ground.

Professor Forbes—This same procedure that he recommends, for agricultural reasons, is equally applicable to injury by the white grub. It will not so completely suppress and prevent injury by the white grub as it will that by the wireworm; nevertheless it can not help but have a very favorable effect to reduce injury from that source also to grass and corn.

A Delegate—Is clover included in these grass lands, as being subject to the wireworm; clover sod alone?

Professor Forbes—No.

Mr. Goebel—In speaking of the wireworm being so destructive to corn, and not being able to do anything for it, I had a sort of an experiment of my own a number of years ago in a piece of old pasture that had, as you stated, been in grass for many years, or, indeed, had never been broken up; and along the edge of the low land, not exactly in the low land nor the higher part of it, was a strip, circling the low land, that I could raise nothing at all on. It was almost impossible to grow corn there that would ear out. I did not know what to do with it. I sowed it to buckwheat, and tried everything, but I couldn't do anything with it, and finally I put on a coat of coarse horse manure. I think it was the ammonia in it that was the aid in bringing a crop. I raised a big crop of corn after that coat of horse manure, which would amount to nothing as fertilization.

Mr. Lee—We would like to hear just a little bit about the cutworm.

Professor Forbes—I shall not need to say much in reference to cutworms, because the economics of the matter all depend upon one fact.

The eggs which hatch the cutworms are laid by moths or millers (See Fig. 1443) in the grass, as a rule, in the latter part of the summer and the early fall. There are many kinds of them, and they vary somewhat in this respect. The eggs being laid in grass lands in late summer and early fall, hatch that same season, and the caterpillar, which we call the cutworm (See Fig. 370), gets about half grown, when the winter overtakes it. In the spring it completes its growth, feeding upon the grass, unless the ground in the meantime has been planted to some other crop. Now, the earlier in the fall grass lands which are to be planted to corn are plowed, the earlier in the summer you are willing to do that, the less likely those grass lands are to have become stocked with the eggs of the cutworm moth, and the less likely the young cutworms themselves are to find food during the remainder of the fall and the early spring. This is not a theoretical supposition merely, but it has been proven again and again, by actual practice and experiment, that fall plowing is an important protection to corn against cutworm injury the following year, and that, generally speaking, the earlier the sod is plowed in fall the less is the liability to cutworm injury the next year on that ground.

Mr. Patterson—It is not very often that we have this gentleman from Champaign up here in Will county, and he may have answered my question, because I do not hear very well, but if he has answered it, it will be all right, and if he has not answered it, he can. What is the worst bug or worm that we have on corn in Will county?

Professor Forbes—Well, I just wish I had assistants enough so that I could send one up here to make a special study of the entomology of this county; but there are but two for the whole State of Illinois. One of them goes into the field, and the other stays at home and takes care of what the first sends in. I must say that I am not an expert on the entomology of Will county. I do not know your worst insect here.

A Delegate—I would like to hear something about the bill-bug.

Professor Forbes—The bill-bug is an interesting creature. Here he is (Fig. 353). You all know that peculiar appearance of the corn leaf in the spring. I do not believe many of you know how important the injury to the corn is which that peculiar appearance signifies. Indeed I did not know it until a year or two ago, and the matter which I want to give you in regard to it is not yet in print. It is one of the results of an investigation that we have made during the last two years. This injury you all must have wondered about. You have recognized it, of course, as due to insects; but what insect could take the trouble and have the ingenuity to make several rows of holes across the leaf of corn, all just alike? This is the fellow that does it; shown down here (Fig. 353). That is the way it looks when you look at it from one side (Lower Fig.) It is about seven-eighths of an inch long when full grown. Here is a picture of its larva or young(Fig. 1359.) I doubt if any of you ever saw that larva; or if you did, you surely did not connect it with this beetle. You never saw it unless you looked into a bulb of timothy, in an old timothy field, which had been hollowed out. In the cavity of the hollowed-out bulb you would find a thick bodied grub like that, without any legs, fat, wrinkled, soft, with a hard, round head and no other marks to distinguish it. The peculiar injury shown here is done by this beetle. Its head is drawn out into an enormously long and slender nose or snout, and the mouth, at the extreme tip of that snout, is provided with a pair of small jaws, strong for their size but very small. Whenever it wants anything to eat it sinks this beak into the interior of the stalk of some plant and then, by means of these small jaws at the tip of the snout, it bites and chews and swallows the soft, succulent interior substance of the plant. It punctures the corn plant near the surface of the ground, sometimes an inch or so below and sometimes an inch or so above, and it always stands with its head downward and its legs so firmly locked around the plant that you would have some difficulty in pulling it off. When the plant is small, before the leaf is expanded. when it is wrapped several times around the stalk, a single thrust of that beak into the corn-stalk will go several times through the same leaf; just as if you were to take my handkerchief and wrap it several times around this cane and then cut a hole through the handkerchief to the cane; upon unfolding it you would find a row of holes exactly alike across the handkerchief. This bill-bug resorts to corn for food but it does not breed there. It lays its eggs in timothy. This injury, consequently, is confined almost wholly to ground which was in timothy the year before.

I happen to have in my pocket some figures, based upon a careful investigation of a case of injury of this sort, made by one of my assistants under my direction two years ago and worked out in detail at my office this year. We found in this field. by comparing hills of corn which had been infested by the corn bill-bug, as shown by injury to the leaves, with those which had not been so infested, and, taking an equal number of each, that 29 per cent of the hills in this field had been infested. and in those hills which had been infested 14 per cent of the stalks had been killed. We found that 33 per cent of the stalks which had not been killed in these infested hills had been so injured that they either fell to the ground or leaned sufficiently to show that they were noticeably weakened near the earth. We found that 47 per cent in all of the corn stalks had either been killed or injured. We found that 30 per cent of the stalks in the hills which had been infested by the corn bill-bug had been rendered barren. We found that the number of ears in the hills infested by this bill-bug was 40 per cent less than the number of ears in the hills which had not been so infested, and that an additional 26 per cent of the ears in these infested hills had been damaged so that they were not good average corn. Or, taking the whole field over, we found that the yield of the entire field had been reduced about 18 per cent in quantity to say nothing of the loss in quality—and I think that 18 per cent of the yield of a corn field is a pretty large percentage of the profit of the crop. It seems to me that this corn bill-bug had virtually made corn raising unprofitable for that farmer that year. It costs as much to raise an infested crop of corn as one free from infestation, and consequently any loss due to infestation is a loss of profit.

The old timothy plants in this field showed that the bulbs had been extensively hollowed out by the larvæ of the bill-bugs. In adjacent timothy fields, the larvæ of the bill-bug were found numerous in the roots of the timothy in proportion to the length of time that the ground had been in timothy. Making an extensive comparison of the condition of corn fields in that neighborhood we found that in every case where the timothy had been plowed in fall, no matter how long the ground had been in timothy during the years preceding, the corn was uninjured by the bill-bug. In every case in which timothy was plowed in the spring, as a preparation for corn planting, the corn was injured in proportion to the length of time during which the ground had been in timothy.

A Delegate—I have a field of corn that had been plowed in the fall, that was injured by this bill-bug last summer.

Professor Forbes—I am glad to know about that. I have a record of one other such case. We found afterwards that from ten to twenty per cent of the bulbs of timothy in this neighborhood were infested by these larvæ where the ground had been in timothy only two years in succession. Where it had been in timothy three or four years in succession, from fifty to seventy-five per cent of the bulbous roots had been hollowed out; an injury which must have made itself apparent in the yield of hay. This was an unusal situation.

A Delegate—That field of mine was in timothy for sixteen years, though.

Professor Forbes—I think you are done with the insects injurious to the corn plant.

A Delegate—I would like to ask one question. Do you think that quack-grass, velvet weeds, morning-glories and Canada thistles are as injurious to the crops as some of the bugs?

Professor Forbes—You may call insects the animal weeds of the corn field, and just as deserving of systematic and careful attention and treatment as the weeds of the field are; more injurious than weeds in some cases, for the reason that the weeds feed only upon the soil, merely competing with the plant, whereas the insect feeds upon the plant itself and destroys it immediately. There are some other things that I would like to say if I had time, but I am sure you have had enough. [Applause.]

The chairman then read the convention a cordial invitation from the Economy Light and Power Company to visit their electric light and power plant, run by water power from the Chicago Drainage Channel.

Mrs. Edith Bartlett, of Chicago, then gave a reading, entitled, "Them Oxen," and for an encore, read "The Italian's View on the Labor Question," both of which were well received and applauded.

Convention of Delegates.

The convention of delegates of the Illinois Farmers' Institute for the election of directors for the even numbered congressional districts was held in the opera house, Joliet, Ill., at 5:00 o'clock, p. m., Tuesday, Feb. 21, 1905, President Wyman presiding.

The Committee on Credentials presented the following report:

To the Convention of Delegates of the Illinois Farmers' Institute:

Gentlemen—We, your Committee on Credentials, beg leave to report that we have examined the credentials of the several delegates representing the respective districts and find the following named persons entitled to seats in this convention:

Congressional districts 1 to 9—	James Frake	Chicago
	C. P. Reynolds	Chicago
	M. K. Sweet	Chicago
Congressional district No. 10—	Warren Holland	Antioch
	D. M. White	Antioch
Congressional district No. 11—	Amos Burton	Geneva
	Joseph Newman	Elgin
	H. Bird	Lockport
	W. S. Finch	Joliet
Congressional district No. 12—	E. Wilmarth	Sycamore
	Henry Park	Sycamore
	B. A. Williams	Sycamore
	W. A. Walley	Morris
	A. C. Gabel	Yorkville
	Wm. Barrow	Yorkville
	G. A. Crowden	Ottawa
	F. F. Funk	Ottawa
	E. M. Breckenridge	Rockford
	O. J. Kern	Rockford
Congressional district No. 13—	F. D. Lynn	Byron
	G. A. Lazier	Rochelle
	Chas. Walkup	Rochelle
	M. T. Lee	Sterling
Congressional district No. 14—	O. O. Gregg	Bowen
	Dr. W. H. Lyford	Port Byron
	E. N. Cobb	Monmouth
Congressional district No. 15—	John Wertman	Lewistown
	R. P. McCann	Orion
	Henry Combes	Cambridge
	J. W. Hunter	Abingdon
	Gleason Breed	Galesburg
	Charles E. X. Smith	Galesburg
Congressional district No. 16—	C. C. Pervier	Sheffield
	E. P. Lovejoy	Princeton
	W. L. Golding	Wyanet
	H. A. Winter	Wenona
	Owen Cottingham	Trivoli
	J. W. Dysart	Granville
	Peter Sweitzer	Morton
	H. S. Griesemer	Hopedale
	John Walters	Tazewell
Congressional district No. 17—	W. S. Kenney	Loda
	Wm. Cooper	Beeson
	C. L. Mays	Bloomington
	W. C. Barlow	Bloomington
	S. N. King	Bloomington
	S. J. Black	Washburn
Congressional district No. 18—	D. Brumback	Gilman
	F. I. Mann	Gilman
	Thomas Clifton	Woodland
Congressional district No. 19—	Walter A. Rowe	Decatur
	W. L. Rhodes	Bethany
	J. H. Sharp	Bethany
	Robert M. Dobson	Cerro Gordo
	I. S. Raymond	Sidney

Congressional district No. 20—	F. D. Moulton	White Hall
	F. E. Baker	White Hall
	Chas. E. Himmel	Topeka
	Mrs. H. C. Harpham	Havana
	Will H. Young	Athens
	Howard Williams	Athens
	Geo. W. Woodall	Winchester
	C. S. Doyle	Winchester
	James Wilson	Winchester
	W. B. Rigg	Mt. Sterling
	G. F. Bines	Mt. Sterling
	Robert Means	Hersman
	Fred H. Rankin	Urbana
	M. B. Ross	White Hall
	D. S. Dalbey	Jerseyville
Congressional district No. 21—	W. E. Holben	Edinburg
	W. A. Van Duyn	Pawnee
Congressional district No. 22—	Frank Troeckler	Bethalto
	Frank E. Culp	Bethalto
	Joel Williams	Bethalto
	Herman Mueller	Waterloo
	John Schneider	Waterloo
	Balzer Schmidt	Waterloo
	E. P. Seibert	Ashley
Congressional district No. 23—	Joseph Oldfield	Vandalia
Congressional district No. 24—	Ansel Jack	Bone Gap
	A. Winterberger	Junction
	J. F. Buckner	Vienna
	Wm. M. Grissom, Jr	Vienna
	J. F. McCartney	Metropolis
	C. W. Husman	Metropolis
	A. W. Walker	Golconda
	George M. Norris	Fairfield

Respectfully submitted,

(Signed)

Merrill K. Sweet,
S. B. Mason,
G. A. Crowden,
Committee.

On motion, the report of the committee was adopted.

The delegates representing the even numbered congressional districts reported the election of directors as follows:

Second Congressional district—	B. R. Pierce	562 45th st., Chicago
Fourth Congressional district—	W. Malcolm Manley	828 W. 43d st., Chicago
Sixth Congressional district—	F. C. Rossiter	91 Washington st., Chicago
Eighth Congressional district—	John M. Clark	143 W. Randolph st., Chicago
Tenth Congressional district—	Ralph W. Chittenden	Gurnee
Twelfth Congressional district—	B. F. Wyman	Sycamore
Fourteenth Congressional district—	Wm. H. Lyfort	Port Byron
Sixteenth Congressional district—	Ralph Allen	Delavan
Eighteenth Congressional district—	F. I. Mann	Gilman
Twentieth Congressional district—	A. P. Grout	Winchester
Twenty-second Congressional district—	E. W. Burroughs	Edwardsville
Twenty-fourth Congressional district—	J. F. McCartney	Metropolis

There being no further business to transact the convention of delegates adjourned.

GENERAL SESSION.

UNIVERSALIST CHURCH, TUESDAY, Feb. 21, 1905, 7:30 P. M.

President Wyman—We commence our exercises this evening by listening to a recitation, a reading, from Mrs. Bartlett of Chicago, "The Village Dressmaker," by Kate Douglas Wiggin.

President Wyman—Professor Harvey of Wisconsin has failed to get here on time. But we have with us Miss Van Rensselaer, supervisor of farmers' wives' reading course, college of agriculture, Cornell University, Ithica, New York, and she will take his place on the program. Miss Van Rensselaer will speak to us on

MISS VAN RENSSELAER.

THE RELATION OF THE FARM HOME TO THE UNIVERSITY.

LADIES AND GENTLEMEN:—The agricultural college has received very many of the young people from the farm. It is a rather novel idea to have the college go to the home, as in the university extension movement, but it is a good idea, since it is not the thing for the fathers and mothers to fall far behind their children in their understanding of the science of living. Especially is this so in the farm home, where all are so closely connected in the farm work. It is a partnership affair existing in the farm life which does not exist to the same extent in other lines. When a farmer marries, he is fortunate to find some one who knows something about farming. If a banker marries, he does not necessarily study to find some one who knows about banking. If a lawyer marries he does not seek to find someone who has studied law. Probably a farmer asks himself whether a woman can help run a farm, whether a woman can look after the poultry, whether she can milk the cows, in case of necessity. And if there is a lamb that needs attention, the farmer's wife must be the one to take care of it. If there is a person sick in the neighborhood, the farmer's wife is called upon, rather than to secure a professional nurse. She is so far removed from the market that if the bread is not good, she cannot go around the corner to the bakery for a loaf of bread. She cannot buy pies and make her husband think they are her own make. If he brings home company, or if city friends come into the country occasionally to get a good square meal. she must have one of the best meals that can be served. Her ambition to excel is great and she is most successful. And yet those who live in the city or village or town are forgetting that perhaps the farmer and his family, when they come into the city, would like to drop into one of those homes and spend a little time in somebody else's dining room or parlor.

The farmer's wife attends the grange and farmers' institute, and has the same interest that he has. She listens with him and they go home and practice; she often gives advice, and he follows it, and is successful therefrom very many times. She is interested in the farm. The children, as they grow up in farm home, are engaged in the partnership. They are given a calf, or a colt. It may be different when the cow or horse is sold—the sense of ownership has passed away, and it is forgotten whose colt it was and whose calf it was.

Sometimes the boy thinks it is better to seek his fortunes elsewhere than on the farm. And often the girl feels it is better for her to go away from home to earn her living. She is not quite contented in the farm home. And that is one of the reasons why we believe in the university extension for the farm, so that the boys and girls will find something which appeals to *them* so that they will desire to stay there, not because there is no one else to do the work, but because they are vitally interested. It is a scientific business and "the fool of the family" would better not stay on the farm if he expects to be a sucessful man.

A great deal is expected of the farmer and his family, hence his need for broad education. There is a piece of statuary having a very large sale in Germany. It consists of a series of steps ascending to a level platform. On each one of those steps is a human figure. There is the nobleman bearing his sword; the emperor with his scepter and crown; the priest in his cassock; the beggar with his pouch and staff; the Jew and the farmer. On each of those figures is an inscription. The emperor says, "I rule over you all." The soldier, "I protect you all." The nobleman, "I lord it over you all." The begar, "I beg alms of you all." The Jew, who, by the way, occupies the highest place rather than the emperor, says "I make money out of you all." And the farmer on the lowest step, bending under his burden, a sack of grain on his back, says "God's will be done, but I feed all six of you."

University Extension provides that the farmer who did not go through college shall be educated for his own special work and the farmer's wife for her work; and the children shall become interested in those things which will give them a wide outlook upon agricultural affairs.

Several years ago in New York state, there was organized a farmers' reading-course for the farmer who could not go to college. With it was organized a nature study course for the children and the work was extended to the schools. The teachers may be versed in the studies in which they have passed their examinations, but perhaps they are not informed upon agricultural subjects and they need aid in giving the instruction which it is desirable for them to have in the rural school in training for the various lines of work required for farm life. The home nature study is for the teachers, and the children have the junior naturalists' work. And then a little later, the question arose, "What about the farmers wives?" And many persons said, "The farmer's wife will not listen to instruction. She is too busy." But the attempt was made. At the present time we have over 15,000 farmers' wives in the state who are taking the course of reading prescribed. Although they do not all write letters and they do not all join farmers wives' clubs, they have given evidence of much interest in the work.

We send with those bulletins in the farmers' reading course and in the farmers' wives' reading course what is called a discussion paper. These questions are not technical but they are questions which arouse thought. The chilren have the same line of work. They send their dues, not in money, but in letters written to the chief of the department, written often in their school hours and under the guidance of the teachers. The farmers and farmers' wives also have these discussion papers, and many ask questions. The women ask in regard to the raising of cream, the food for the table. bringing the water from the hilltop, getting the water into the house, and in regard to drainage. The professors in the various departments to whom these questions are referred are willing to discuss these questions so that it is possible for the writers to at least think out their plans.

These bulletins are not as technical in their nature as are many government bulletins. One woman will say, "Those lessons are too easy and simple. They will not inspire much thought on the part of the farmer or farmers' wife." Another woman, "Those lessons are so hard. We don't know what you mean by protein; we don't know what you mean by carbo-hydrates. Can't you give us something easier?" We try not to make them too hard. We believe it is easier to reach the general line of readers than a few. We find that the studies which command the most attention on the part of the farmer's family are those pertaining to making the work easier.

It has been a most interesting study from the very beginning, to see how the men as well as the women really rouse themselves to the problems of making life easier on the farm. And while we talk about saving strength and saving steps, and talk it over and over again, we still have willing listeners upon that subject, and women who are extremely anxious to know if it is possible for them to do the work they have and not become worn out. The men sometimes say we are causing them some expense, because they have to put in shelves where they did not have any and they have to build ice houses on the farm because the women are so enthusiastic about it, and they are asking for refrigerators. But they seem to be pleased about it after all. A man said that he had recently removed an old chimney that had been in the homestead ever sine the house was built. He said, "My wife has washed her dishes on one side of that chimney and gone around and put them away on the other side for years and years. And," he said, "I have asked her to let it be taken out year after year, but we did not want to sacrifice it. But," he said, "I have removed it, although it caused a good deal of heartache to have it go." Another man remarked that it had cost him about fifty dollars to read our bulletin upon saving steps and sanitation, that he had been required to put in an ice-box in connection with his kitchen, but he said, "I want to tell you that it has paid for itself already in the work it has saved for the family, and I can see that it has saved provisions at the same time."

There has been another line of work with which I think you are more acquainted in Illinois than with the reading courses and that is the short course work. One great question is whether you will admit boys and girls to the college who are not qualified to enter with those of the arts course and the various other long courses of the college. If not allowed to enter upon the same requirements we must make our rural schools better; make the students better qualified to enter college rather than say to them, "No, you cannot come here, because you cannot pass the entrance examinations." I believe in high standards for the agricultural students and our preparatory schools should provide adequate instruction to prepare a student for the regular scientific agricultural work and until that provision is made, a great many boys in this State and in other states, will be debarred from anything aside from a rural school education and that which they can get from casual reading unless a special or short course is provided in the college. Special courses in agriculture then must take the place of the regular courses for a large majority of students, boys as well as girls. The boys and girls who come into the college for a short course meet some obstacles. There are at the present time over 200 students who have come to the university for eleven week's instructions. They call them "Shorthorns." It is the general term all over the campus and they are proud of the name. It is gratifying to watch those boys and girls as they come from the farm home and from the rural school. Our rural schools are not as good as they should be. I have heard of the good work done in some counties of Illinois in the rural schools and you should be congratulated. We know that in the rural schools we have not given enough attention to English and to those studies which would prepare the boy for college work and he comes into the university handicapped by that condition. When it comes to his laboratory work or going upon the farm in the experimental work he does well. I have noted with the utmost satisfaction that no class of agricultural students ever comes into the university for an eleven or twelve week's course, or for a year's course, for we must call that special, without commending the respect of the faculty and of the students. People like to have those boys and girls come into their homes. The professors are glad to have them in their class work. They are in earnest. I do not believe there is any class of individuals who come into the university that get in the same length of time, as much as those boys and girls who come direct from the farms to the university for work. They know what they are there for. They know what it has cost for them to come. They are not spending their time and saying, "I have four years college course and my father will pay the bills." They know the value of a dollar. They know how to improve their time and they come for real work.

It does the other college boys good to see those boys and girls from the farms there. They are no more strange in college than some city people are in the country. A banker failed in health. He thought he would get his health back on the farm. He went to the home of a family with whom he had done business for some years and said, "I should like to hire out." The farmer said, "What can you do?" "Why," he said, "I think I can do most anything." "All right," said the farmer, "take the milking stool and go down in the pasture and milk the cow." He wasn't quite prepared for that particular work, nevertheless he went. When he was gone an hour and had not returned the farmer went down to find the man wandering around the pasture. He said to him, "Have you milked the cow?" He said, "No, I have been chasing her around here an hour trying to get her to sit down on this stool so I could milk her." [Laughter.]

In my respect for the farmer boy and his knowledge of practical affairs that poem of Riley's has appealed to me strongly:

"The Boy lives on our farm, he's not
Afeard o' horses none!
An' he can make 'em lope, er trot,
Er rack, er pace, er run.
Sometimes he drives two horses, when
He comes to town an' brings
A wagon-full o' 'taters nen,
An' roastin' ears an' things.

"Two horses is 'a team,' he says,
An' when you drive or hitch,
The right-un's a 'near-horse,' I guess,
Er 'off,' I don't know which.
The Boy lives on our farm, he told
Me, too, 'at he can see,
By lookin' at their teeth, how old
A horse is, to a T.

"I'd be the gladdest boy alive
Ef I knowed much as that,
An' could stand up like him an' drive,
An' ist push back my hat,
Like he comes skallyhootin' through
Our alley, with one arm
A-wavin' fare-ye-well! to you—
The Boy lives on our farm!"

He commands appreciation wherever he goes. He may have money in the bank. He may have a large number of acres to look forward to as his own; but he is not the boy to go into college and spend it foolishly. A certain boy who was master of a grange came with two nice horses to meet a speaker of that grange. He said: "We have a big farm here that is to be mine sometime, I suppose, and I am running it now. But I wish I knew more. My father does not want me to run it just as he did. I wish I could come to Cornell and get a little training." It was suggested that he might take the short course. This winter, a letter came, saying: "I am coming to Cornell to take the short course. I have managed to get somebody to take my place at home. Do you know where I can stop?" He came into the household where there wasn't a spare room in the house. The rooms in his mother's home were clean and comfortable and it would seem that the boy ought to find just as good a place as he had at home. It was remarked that there was a room up in the attic. He said: "I would like to look at it." He looked it over and said: "That is all right. It will be cool and comfortable to study in. I will take that." He came among people who were professors and instructors and students, and it might well be feared that he would feel a little strange there. I want to tell you that there is not a person in that house but has said, "What a fine boy he is! He ought to stay and take the full course." He was a farmer boy. He could do things. Although he did not understand all the conventional ways, he was full of natural courtesy and has won the hearty esteem of the entire household. If an emergency occurred in some part of the house, and the water came pouring down through the plaster, that boy knew what to do and did it. If there is danger of the pipes freezing, or if one has frozen, and there is no one around in authority, this boy always knew exactly what to do. He was resourceful and energetic and so full of common sense and everyday wisdom that those people who have been spending their lives in the city loved to talk with him. At the close of the term, he said: "I realize now that eleven weeks is a very short time to get what I want—now I want to stay a year." When the boys in college get a little instruction, they want more. Many say: "We shall have to go home and help out with the work, but perhaps we can come again sometime." It is not the amount of knowledge that the student will take home, so much as it is that he has learned where to find things. He knows what book to consult. He knows where to get those books. He knows how to secure his knowledge.

I think this question was asked here a year ago: "Is there anything to prevent a boy's going into a college and holding his head up with the rest of the boys if he has come from a farm without the same training that the other boys have had?" I can say in an unqualified way that he need have no trouble at all. What if he does? He can hold up his head just as high as anybody else. He has a certain practical experience which will make him resourceful under all circumstances. That boy who is sent to college when he is 16 or 18, and furnished all the money that he needs, and goes through college, spends his four years, and is put out upon the world, is not so fortunate as the boy who spends some time on the farm in a practical sort of way, and then takes a college education to supplement it, and goes on about his regular business.

Inasmuch as I was asked to come here and speak of some special things about which you are thinking and doing, I want you to be very free to ask questions, and I will tell you anything I have omitted.

Superintendent Hall—Do you think the short course increases or diminishes the number that take the long courses in your state?

Miss Van Rensselaer—I know that it increases it. The fact has been demonstrated that boys who come for a short course have in many instances arranged to come back. A question often asked the short course boy is, "Do you expect to come back?" And he often says, "I expect to come back if I can possibly arrange it." It is the desire planted in him that is preparing the way for a longer course. A great many come back who do not expect to do so when they come for the short course.

A Delegate—Does not your short course get hold of a certain class of boys that your long course would never reach?

Miss Van Ransselaer—Yes, in two ways. We do not have the same qualifications for entrance in the short course as in the long course. It must be determined whether they are well enough grounded so that they can understand the work. For a long course, they must have their entrance examination. And then when a boy enters the long course, he must realize that for four years, or two years in the shorter course, he must give up all work on a farm, or largely so. And there are so many beys who can not do it. but who can come for eleven or twelve weeks. It means a chance of a lifetime for these particular boys.

Director Rossiter—Is there any way you can advertise your college any better than by this short course advertisement?

Miss Van Rensselaer—The extent of the advertising given the college is surprising. An effort is made in every county to bring these students there for the short course. Of course it is free of tuition. Those boys go home and talk about it after getting a taste of the college life, until others get an idea of coming. It does not help the agricultural course alone. I doubt if there is anything that will help the college in the line of advertising so much as this extension work and the short course. The college gets very enthusiastic friends among the farmers. In addition, those farm women and farm men who are taking the Cornell reading courses feel an interest in the college which they can·not have otherwise.

Mr. Frake—Have you a short course for girls?

Miss Van Rensselaer—No. Perhaps Illinois will get it before New York does. You have a fine domestic science department already, and we have not. We have three short courses in the winter—one general agriculture, another poultry, and another the dairy—and Professor Bailey, director of the college of agriculture, announces that it is hoped to have two more short courses next winter; one a domestic science course, and one a horticulture course.

A Delegate—Does your short course give college credit for the long course work?

Miss Van Rensselaer—It does not. The students are granted a certificate on the completion of the short course work, but when they enter for the long course, it does not count on the entrance requirements.

Delegate—I understand that a boy from the farm would have to have certain qualifications to enter the long course. If he did not have those qualifications and entered the short course with credit, could he then enter the long course?

Miss Van Rensselaer—Not the regular course without making up those qualifications. He could be a special student in agriculture, and could have a two years' course, or stay there as long as he wished, but he could never be given the same diploma the regular student has; he could go into the same classes with a regular student. He could not get a diploma nor a degree.

Mr. Frake—But he would have a certificate?

Miss Van Rensselaer—He would have a certificate if he earns it. He would need to pass fifteen hours of work in order to obtain it.

A Delegate—Wouldn't there be some studies that he would not be qualified to take?

Miss Van Rensselaer—To some extent. For instance, if he never had chemistry, it would be necessary for him to qualify to some extent to take chemistry there.

A Delegate—What qualifications are necessary in order to enter the long course?

Miss Van Rensselaer—There are examinations taken in the high schools or in the university, and for a certain number of counts, varying in our different departments, students are allowed to enter.

Students from out of the state come there and take the same examinations in order to enter the course. I understand that it is the same in the agricultural that it is in the arts courses.

A Delegate—This certificate you would give to a farmer would amount to the same thing with any other class of young men that should study any certain specialty in the college?

Miss Van Rensselaer—There is no course in the college comparable with this course.

Delegate—The diploma would be like a diploma in a college where they had general studies, and would signify that he was a graduate in all the general studies?

Miss Van Rensselaer—Yes. In the studies required for his agricultural course.

Delegate—And the certificate would indicate what he had done in that particular degree?

Miss Van Rensselaer—Yes. The demand for students to take positions is very great, and the faculty is applied to in all departments for its students.

Delegate—How many students are there in the poultry course?

Miss Van Rensselaer—About 100 in the long poultry course and 17 in the short course.

President Wyman—A few weeks ago I was at Rockford at a Winnebago county farmers' institute. There are some boys' clubs in that county. The boys are very much interested. They came to the institute until they filled the large Memorial hall, and when I went out of the institute building after the hall was filled, the streets were still full of boys and girls. Superintendent Kern is mainly responsible for that condition of affairs, and he will address us tonight on

BOYS' CLUBS.

I want to say a word to you in behalf of the country boy. I sympathize with the country boy, because I was a country boy myself, and went to a country school down in the central part of the State of Illinois until 15 or 16 and then quit the country school. After the country boys get to that age where they are going over and over the same things in the country school they get tired and drop out, and many don't go anywhere else to school. After I was 21 I had to earn enough money on the farm to start off to college; and I entered away down in a class of boys in knee pants; and it was pretty difficult to go into recitation, green as I was. And so I sympathize with the country boy. And that is one of the main reasons why I organized my boys' club. I wanted to put the country boy in touch with all the enrichment that should go with the country life; put him in touch with the agricultural college and experiment station, and literature which could be taken into the country home, and to create a new ideal in the country home with reference to the new agriculture which we are entering upon. I spent nearly two months last summer at the St. Louis exposition trying to find out something about two things. First, I wanted to find out what was being done in the way of higher education for the American farmer. And those of you who had time to stop and look at the educational exhibit know how much there was to be learned there. Secretary Wilson tells us that $10,000,000.00 were spent last year in the higher education of the farmer and in sending out agricultural literature. Some of that literature should reach the boys of that great district where there are today several hundred thousand country schools, and give those boys an inspiration with reference to farm life and farm interest.

I wonder where all the country boys are today. I made an enrollment of my country schools, and got all the reports in but one, and expect to find that there when I get back. I have 106 one-room country schools, and just about half of them have 15 or fewer pupils enrolled. Twenty-two of them have 10 or fewer pupils enrolled. The average daily attendance is about 60 per cent of the enrollment. One item of the report was, "How many big boys are in those schools? How many boys over 14?" And I have 168 boys over 14 years old; about an average of one boy and a half to a country school. And you talk about teaching agriculture in the country schools with teachers that come from the city high schools, that don't know a thing about agriculture, and no big boys to teach! The agricultural college is all right, and the short course is all right. I talked about the short course over at Madison on the 4th of February. They have an experiment club of 600 membership, made up of the boys who at one time have attended the agricultural school at Madison. The state gives them a thousand dollars to print their proceedings every year. It used to be that we had to send our boys in Winnebago county to Madison, but now we have an agricultural school of our own. We are proud of our agricultural college, and we are proud of our State university. It has nearly 400 young men there receiving instruction at the college of agriculture. But there are many who never will reach there.

I wanted to find out how many girls were in the country schools over 14 years old; and I have 120 in 106 one-room schools; an average of a little over one to a school. So it is a problem of the country boy and what we shall do, and whether it is necessary for the farmer to organize better schools, and give his boys the best in the way of the enrichment of life, and not have to tear up the farm home from its roots to go into the city and educate the boys and girls. I taught for seven years in the high school in Rockford, and we had over 750 students, with 23 or 24 teachers; and since I left there they have doubled their plant, put in 17 typewriting machines, manual training work, and everything of that kind. So that the boy and girl when they graduate will know how to be more efficient factors in the industrial life of the city of Rockford. It is not expected that they will know about the feeding of stock, the rotation of crops, and all those things that the successful farmer boy of the future must know about. The city high school is built for city necessities, and I claim that we are able to build up out on the farms the country high school, and have all the enrichment of life in the way of literature and social life, and a country high school course suited to the country necessities. I believe that it is coming, but it takes a whole lot of work to create a new attitude among the country people with reference to the boys and girls. I know some farmers say, "What is the use of paying out $5,000.00 for the education of a 50-cent boy?' But how many farmers are giving a 50-cent education to a $5,000.00 boy! [Applause.]

The hardest of all propositions is to genuinely interest the Illinois farmer, the Winnebago county farmer, in an active enlistment for the betterment of the daily schools for the education of his boy. I am pleading for the 80 per cent who never will reach the agricultural school. Let us have many courses at Urbana. Let us have the short course, but let us talk up the country high school, not that it shall be an imitator of the city high school, and everything that will tend to lead the boy into things that he don't find on the farm and field for his intellect. Some way or other many people have an idea that we must have an education to make a living without work. I am trying to create a new ideal among our people. That is the reason why we organized our boys' club; the reason why we went on three great excursions to colleges of agriculture; the reason why, by the encouragement of State Farmers' Institute officers. they are raising high-bred corn and making exhibits at the farmers' institute, and writing their letters to me about it. We try to reach a few of the boys and girls on the farm, and thereby reach the country home, and make them see that this is a new age of country life.

Just a few words about the history of my club. It was started on Feb. 22, 1902. It will be three years old tomorrow. There are 450 enrollments now. Do you remember that year the State roundup meeting was held at Rockford? I received an inspiration there, and on the occasion the children gave a program there I announced I would like to meet them all on Saturday who would like to join a club. I persuaded Professor Rankin and Professor Shamel to stay over and meet the boys in my office. And we had the next morning thirty-seven boys to meet in my room, with three or four fathers. Don't despise a small beginning. It does not take a great hall with a crowd. Inspiration in numbers is a good thing. We had thirty-seven, and called them charter members. Professor Shamel sent to each boy there an ear of his corn. I was down at the corn growers' convention in Champaign in January, and I heard a prominent grower—I like to stand around and listen to what the members are saying—and this man says, "Test your seed corn before you plant it." He says, "I have neighbors drive to my house, eight or nine miles, asking me to test their corn for them. They can do it. It is so simple." As I talked to the teachers' association the other day in central Illinois, I said, "If you want to do one thing in starting agriculture get this one bulletin and begin yourself and test corn, and teach your boys and girls to test corn."

Our membership began to grow. I talked to the boys and teachers, and talked to the parents. And I like to talk through the newspapers. It is a little work to write sometimes when you are tired, but the press is always glad to give me all the space I want. It is worth your while to sit down in the evening and write articles and try to reach the farmer from his own standpoint. It is a hard thing to do, and someway I have not solved it; and I don't know that the State Farmers' Institute has solved it yet. We must reach the farmer on his own ground and appeal to him from his own point of view. If you can tell me how to do that we will get along then.

Don't despise a small beginning with the boys. I have a girls' club, but I am not going to say anything about that, for my topic is boys. We have 450 boys. I talked to the boys, and said, "It don't cost you a cent; give me your name and postoffice address, and I will send it to Superintendent Rankin, superintendent of agricultural college extention work." And the boys are put on his mailing list, and we send them literature; and I trust that the farmers themselves will make good use of it as well as the boys. I know that the officers of farmers' institutes always have deep down in their hearts a great interest in farmers' boys. Let us get hold of the boys; have them at our meetings; have them put on the programs, and train up a new class of workers to take the place of us older people.

I was glad to get this letter from Mr. Hamilton of the agricultural department in Washington, and I will read it to you.

LETTER FROM MR. HAMILTON.

"I now think that the farmers' institute movement must take hold of the country boy and the country girl. We have been dealing with the fathers and mothers thus far, which was a necessity until the value of the institute movement was demonstrated; but we have come now in my opinion, to a time in which it will be possible for us in many states, to go a step further and take hold of the young people who are living on the farm.

Your success in interesting those in your county is proof of the practicability of the plan if it is properly organized and enthusiastically conducted. There is no reason why we cannot change the whole sentiment of our country in a few years, if we go about it in a systematic way. Agriculture can be made popular as well as profitable, if those of us who are interested in country life take hold of the work in the right way, and present the features that appeal to young minds in an attractive way."

I believe that is the great problem, to look after the boys and girls. And so I am glad in the many farmers' institutes that I have visited, all over Illinois, in the last two or three years—I suppose about thirty-five counties,—that they are beginning to recognize the boys and girls. I was glad when Mr. Hall made his report this morning that the boys and girls and teachers are attending the institutes. Why shouldn't they be there to get inspiration? It is a good place for them to be. I do not know whether the State Farmers' Institute will see fit to continue sending 500 grains of high bred corn to the farmer boys of Illinois to carry on their work in that line, but I hope they will not neglect the work. Give the boys something to do, something of their own to think about and look after, and their interest will grow in the things that pertain to the farm and in their fathers' work.

I want to show you some photographs. The first year experiment work was done in the way of sugar beets. These are some of the boys with their sugar beet experiments. It was the last year in which the Illinois legislature made appropriations for sugar beet experiments, and those boys discovered a great many things about the beets. I always like to keep in touch with the college of agriculture, and so I talked over with Mr. Rankin what our boys of Winnebago county should do. And I said to him that up in Janesville, Wisconsin, a great many farmers had quit raising tobacco, and put up a mammoth sugar beet factory; that the newspaper reports told me they had a great banquet there to discuss the subject, and there would be a thousand farmers there raising sugar beets. And Mr. Rankin said, "Let your boys raise a few beets this year, and make some money." Let the boys make some money! Why not? It did me lots of good on the farm when my father gave me something to do that I could make three or four dollars. Encourage the boy to save up money, perhaps to go to the college of agriculture.

Then about our excursions. They are wonderful things for the boys. Here is a boy that had never been on a railroad train before who went to Urbana with us. They cannot be quite the same boys when they come back from those excursions. There we were away off from home 214 miles, with lots of new things to see on the trip, and the visit through the college and experimental station. You cannot begin to tell all the good it did them. It used to be necessary up in Winnebago county that if we wanted to teach our boys to make better butter or better cheese or do better farming, we must send them to Wisconsin. They have a magnificent institution in Madison, but we can go to Urbana now. Our people can go down and see the work and talk with the professors, and I am counting every individual who comes back from there as a missionary for better things.

If I was not limited for time I would read you one boy's experiments with sugar beets. Here are three of my boys in the experiment club. Here are some children, with a school garden.

Our first years work was along the line of sugar beets. Our last two years work has been in the way of raising high bred corn. The state farmers' institute officers said to the boys in Winnebago county, "If you will write a letter to us and send four cents in stamps we will send you 500 grains of high bred corn." Some of the boys in Winnebago county have planted that corn, and they have been most successful. They have done some very good work. The boy wno took first prize last year—12 years old—raised corn at the rate of 125 bushels to the acre. And last year his father saved enough seed to plant fourteen acres, which they said would average 85 bushels to the acre.

Three men from the United States government and three from the college at Urbana have lately spent six weeks in Winnebago making surveys of the soils in that county, and when the surveys are complete maps will be made, and I want one in every school in Winnebago county. Why shouldn't the children know something about the soil in the county in which they are residing, as well as the soil of the Nile valley, or the Philippine possessions? Let all children be brought up in sympathetic relation to their environment. Let them be taught something of the soil, of animal and plant life. So when Professor Coffee was there with the surveying party, I called the boys together, and we explained to them something of the soil survey, and the boys got new ideas with regard to things of that character.

For the two years we have carried on that corn experiment, the boys have had their exhibits of corn at the farmers' institute, and have written me letters about their corn. I will read you one letter. (Reads letter.)

I want to share with the country people the responsibility of the country schools, but when I find so many, many country schools only paying their teachers about $300.00 a year, while the lowest salary paid for a janitor in the city schools of Rockford, a small four room school, is $320.00 a year, I claim that the country boy and country girl are not getting a square deal in an educational way. And if the country people want better schools for their children, they must spend more money, and spend it in a better way. And they can well afford to do it, for the country people as a class are well to do. Get better schools, and then get teachers who can teach your children what they ought to learn. In the letter which I just read, the boy speaks of smut and suckers on his corn. Why, when I plowed corn down in central Illinois nobody ever told me anything about suckers and smut. Corn is king, and I thought that the most significant exhibit I saw at St. Louis last year in that great palace of agriculture, was not the great pyramid of corn, but the best exhibit was the exhibit of the Illinois experiment station, showing seven years result of the breeding and selection of corn. And in this connection I will say that one of my boys the other day got a prize of a $60.00 fine bred hog on some of his corn.

I encourage my boys to keep books on the farm. Rockford is a manufacturing city, and if a manufacturer wants to put a table down at Manila, he must know the cost of the raw material, the cost of manufacture, and freight charges, inclusive of ocean freight, and everything that will enable him to know the total cost to lay the table down at Manila. So must our boys be taught to figure on the cost of their crops. Here is a letter from a boy, giving a detailed statement of the cost of his corn. (Reads.)

I want to talk about our excursions that we went on, but here are some pictures that I want to show you first. This picture here, these figures at the top, represent my boys' experiment club and girls home extension club listening to a stereopticon lecture on birds. Our annual teachers' institute comes this year the last week in March, and I have stereopticon lectures for them every day. One on the Farm, Home and School, a second lecture is on School Gardens, by Dick Crosbey of Washington. Another lecture is on the newest things in agriculture, by Prin. K. C. Davis, of the Dunn County Wisconsin Agricultural School.

This picture represents our first excursion to Urbana. Two hundred fourteen miles away from home, fare one way $5.50, but we had the round trip for $2.50. Two hundred eighty-six people altogether went. For the first time they heard of bacteria and the inoculation of soil. The girls went through the domestic science association building, and we are going back there again as soon as the $80,000.00 building for women is completed.

Last year we concluded to go to Ames, Iowa. That is over 300 miles from Rockford, and the fare one way was $8.18, but the Northwestern road gave us a round trip for $4.00. and we had 201 people with us. Many of them saw the Mississippi for the first time, and in going across the river we saw a raft of logs. I tell you it was a great sight for those boys and girls. They wanted to know why those logs were there, and where they came from, and where they were going. Why is it necessary for Michigan to have a chair of forestry in the college of agriculture? Why is Illinois asking for it? Every boy and girl who plants trees and flowers around school yards is taking part in the great forestry movement; and there is the great secret of keeping the boys and girls on the farm, making things productive. Why won't trees grow in the country school yard when they will grow across the road in the farmer's field?

At Ames we inspected the soil department of the engineering building, the alfalfa fields, and all those things, and I wondered how many of the boys of Iowa knew anything about the "blue gray" experiments in live stock in their own college of agriculture. And then I wondered how many of the farmers and boys of our State knew about those things.

In all there have been 686 persons who have gone on these excursions, practically a new party every time. I am counting in a certain way that every person returning interests two other persons by telling them what he saw. Thus 2,000 persons are having the work of the college of agriculture and the experiment station brought home to them in a very practical way. Then the newspapers give me lots of space, and it is so fully advertised in this way that thousands of other persons have been interested in the work of the college of agriculture and the experiment station. So I count this great missionary work.

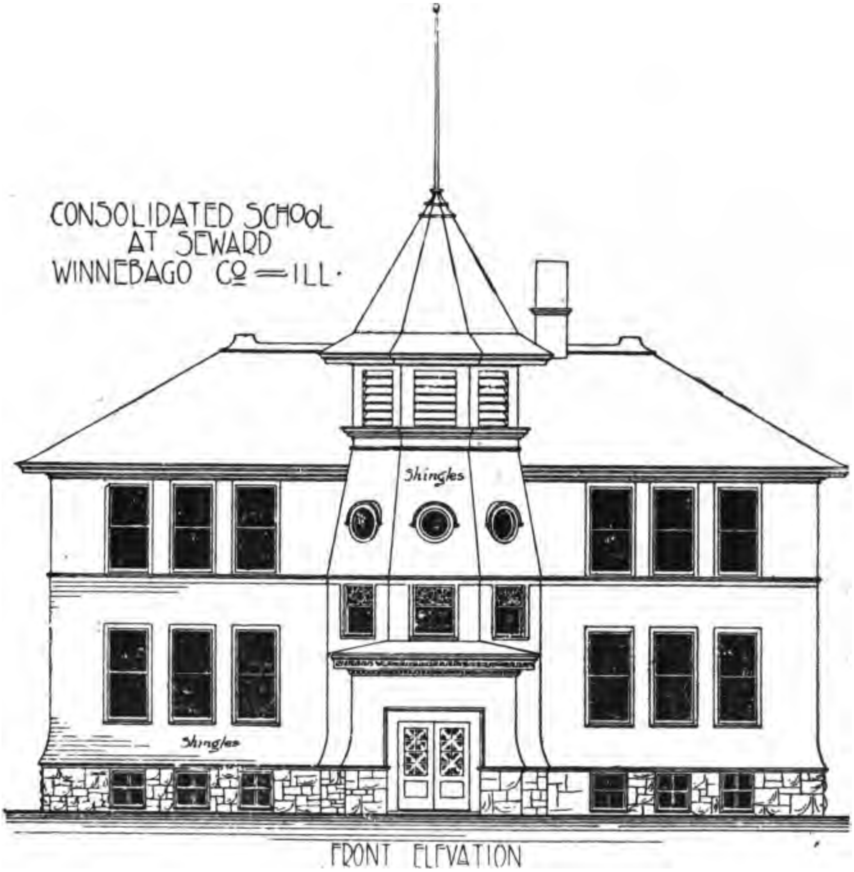
Next year we are going to Madison, the 2d day of June, and come back the 3d day of June. Here is a letter from one of my boys. It comes right in line with what was said by Miss Van Rensselaer in regard to the long and short courses. (Reads letter from boy at Cranberry Experiment Station, Grand Rapids, Wis.) Sometime ago I was over in Wisconsin, and the very first young man I met when I went into the new agricultural building at Madison that spoke to me was this young man. He had graduated from a short course, and was then having charge of some experimental work in the growing of cranberries. This little incident only illustrates what can be done in the way of giving these boys an inspiration for their work.

I think I have talked long enough on the boys' club. I could say a whole lot more things. We are going to Madison next year. I am going over to the Michigan round-up next week to talk to the state farmers institute there; and if I can I want to inspect their college and experiment station. I believe the boys and girls and fathers and mothers who come back from these excursions have newer and better ideas and are prepared to do better work. We are sending them literature and putting them in touch with new things. We are trying to get hold of the boy and the home and educate the rising generation for better things. And when the boys of today become the elders of tomorrow they shall be far better prepared to take hold of the duties and responsibilities that fall upon them.

Now about school gardens. The best way to have a school garden is to have it. But I thought if instruction in agriculture is to amount to anything the children must actually do something. If it is no more than a corner of the school ground let them dig it up. They have had trouble in our county because the soil has never been disturbed before. It is virgin and it takes about two years to get the wild nature out of it. About seventy schools have been engaged in school garden work. If agriculture in the country school means anything, it is not all in taking a text book and getting something about the soil out of it. We have the children to do things. I suppose if I should say that in the country school of the future that the children shall learn with books half a day and the other half day they shall be doing things in manual training and shop work and all those things you would think I was away off the track. But you wait and see. More marvelous things than that have happened. Let them get experience in the preparation of the soil for the seed bed. Let them learn that if they make a failure the cause of it is bad seed, lack of attention, or whatever the particular reason may be.

I sent to Secretary of Agriculture Wilson for his last annual reports and he gave me the compliment of being the first county superintendent in the United States that had asked him for his annual report, and said that the children in the country should be cared for as well as the few students who were able to go to the college of agriculture. I am glad the college of agriculture is turning its attention to the country schools. I am glad that Mr. Hayes, the new assistant secretary, is going to have that as his work.

This picture represents a design given to a new school when we brought three districts together and made a graded school and established a high school room in which we have twenty-five boys and girls coming back to school. And I might say right here that Winnebago county was one of the first in Illinois to adopt even in a small way the consolidated school idea. Suppose it does cost a few dollars more in a township! It brings more children to the schools, better teachers and better schools. What does a few hundred dollars amount to in a township of thirty-six sections of land? We have got to come to it.



The first school gardens that I knew about was in a consular report from the department of agriculture at Washington. I became interested in the matter and started the work in my own county. This is a school garden of a four-room school. That is the way it looked in April and that is the way it appeared in July. You can see the result. I should think city schools could easily have school gardens, but to have them in the country it is a different proposition.

Professor Blair of the Illinois College of Agriculture made the model garden plan for us. I will show you only the pictures of the consolidated school grounds. Here is the corn the boys raised on one of our experimental school gardens. Here we began to plant shrubs and vines and made that a new ideal. I believe in teaching the country child to see the beautiful by bringing out prominently all those things which symbolize an ideal country life. That is worth as much to them as knowing how to raise better corn and more of it.

Here are some school gardens with about eight or ten children in the school. It is not the finest of work but it shows the spirit.

I want to speak to you about one school garden here. I told you we had fifty-three country schools with fifteen or fewer enrolled. Here are our country children. Our people in that county have paid out over $30,000.00 in high school tuition to the different high schools to have a part of their children educated away from home. Wouldn't it be better to have their own country high schools and educate their children at home? But I am also thinking of the great mass of people who cannot send their children to the city high schools where it is not desirable to send them away from home to board. So if you can build up in the country the high school, where the children can be at home, it seems to me we can have the best schools in the world there because we have none of the temptations of life such as the billiard hall and saloon and other dissipations. We can have the best schools in the world out in the country.

Here are seven children in this school and we had to almost rob the cradles to get that number. One is 4, one is 5 and another 6 and yet these little tots and the teacher dug their own fence post holes and put in a fence to keep the chickens out. That shows what a little enthusiasm and a little effort will do.

I want the farmers' institutes all over this State to stand up for the country boy and country girl. I want them to stand for the greater possibilities in the way of an educational uplift for country children. I want them to stand for better country schools in a better way. I want them to stand for all the better things that can come in moral character in this new age to the farm home. [Applause.]

President Wyman—This completes our program for tonight, unless you wish to listen to a reading by Mrs. Bartlett.

Mrs. Bartlett being called for, gave as her selection, "Mrs. Shaver's Recovery."

General Session, Opera House, 10:15 A. M., Feb. 22.

President Wyman presiding.

Honorable A. P. Grout was introduced and addressed the institute on the subject:

HON. A. P. GROUT.

Beef Production, Quality and Type of Beef Cattle.

The question of "blood" or "quality" in beef production has long been a theme for discussion.

It would seem that enough has been said and done in the way of educating the farmers and stock growers of the country along blood lines, to convince anyone that there is no ground left for argument in favor of the unimproved domestic animal, but the great variance in the price of beef cattle at our market centers, due largely to lack of quality, demonstrates that there is yet room for improvement in our cattle.

Years have elapsed since our forefathers in the old country saw the necessity of improvement in their cattle. They went systematically to work to bring about the desired improvements, and one would naturally suppose that the success which crowned their efforts, would render unnecessary the further discussion of this subject, and especially by the active, progressive farmers of Illinois, but if we can judge of results by the quality of the stock seen in the pastures and feed lots of our State, we are forced to the conclusion that the improvement of live stock, and especially beef cattle, has not been looked upon by the great majority of our farmers as a question of real utility but rather as a fad for the special benefit of the rich farmer who does not need seriously to consider it as a money making proposition.

We desire to discuss this question briefly, from a purely business, money making standpoint, for the benefit of every farmer, great or small, who in any way uses live stock in his system of farming.

SELLING FARM PRODUCTS.

The farmer grows grass, hay, grain and other crops upon his farm which he desires to convert into money. Two courses are open to him. He can sell the crude products of his farm in the market or at the elevator, including the fertility taken from the soil in the process of growing, or he can convert this raw material into a variety of products, of vastly less bulk and weight, which can be marketed at much less cost than the material which it took to make it.

If the farmer undertakes to convert the various coarse, bulky products of the farm into a condensed, finished product of greater value, he not only becomes a stock grower, but a manufacturer in every sense of the word. It is evident that the dividend to be declared by this manufacturing plant depends largely upon three things, viz: the cost of the raw material used in the process of manufacturing, the economy of production, and the quality of the finished product.

We can get cheaper raw material, grass, grain and feed for the manufacture of beef by growing larger crops per acre with the same labor and expense now expended upon smaller crops, or we can grow the same amount of grain and grass upon one-half the number of acres with less labor and less expense.

It costs no more to grow a crop of eighty bushels of corn per acre than one of thirty, which will only barely pay the cost of production, and a very low rate of interest on the value of the land.

RETAINING FERTILITY.

The increased production above thirty bushels of corn per acre, therefore, is profit, or it is cheaper raw material for the manufacture of beef.

It needs no explanation to show that the farmer who grows eighty bushels of corn per acre at a given expense has a cheaper feed than the one who only gets thirty bushels for the same money.

It is a well established fact that in order to secure the increased yield, the crops must be fed on the farm where grown, and the fertility as far as possible returned to the land. This necessitates the use of live stock, and renders the establishment of a manufacturing plant a desirable factor in farm economy.

If the business man desires to engage in manufacturing of any kind, he first investigates every phase of the situation, and among the more important questions is that of the latest and most improved machinery. He seeks the machine which has been tested and tried, and proved to be the best and most reliable for his purpose.

He adopts the one that can do the most and best work in the shortest time, and produce a finished product of the highest quality most economically. He does this in order that he may meet competition, and sell his product at a profit.

In beef production the steer is the machine used for the conversion of the various farm crops into money. The character and quality of this animal machine is all important, and in the main determines the profit or loss.

DIFFERENCE IN MACHINES.

There is a great difference in the machines used. Some are improved and others not, but always it is the improved machine, the animal specifically bred for a special purpose, that does the most profitable work and pays the highest price for the products of the farm.

The selection of these machines need not necessarily be a matter of chance as many seem to think, but a matter of accurate and well defined knowledge. Years ago men saw the need or necessity for cattle that would convert their food into flesh in paying quantities.

They began the selection and breeding of animals of the desired qualities. In the course of time they developed the animal with the strong back and well sprung ribs, well developed in the hind quarters, well let down in the flank, with a soft, mellow hide, straight top and bottom lines, and with all, a tendency to get fat at an early age, and to locate as much as possible of the products of the food consumed, where it is worth the most money. This line of breeding has been pursued until certain qualities have become fixed and these cattle have the power to transmit their characteristics to their descendants.

STICK TO BEEF BREEDS.

They are the improved beef cattle of today. They have been developed with a view of doing better things, i. e., that of growing more beef, of better quality and in a shorter time from a given amount of food. In other words, they have been created, from the native wild cattle of centuries ago, by selection and breeding. with a definite object in view. They have been developed and improved year by year for the express purpose of enabling the farmer to sell the various products of his farm at a better price. They are able to do this with certainty because they have acquired the fixed habit of more readily and economically converting their food into a better quality of meat.

The lesson is plain, well defined and can not be mistaken. The farmer of today may as well think of using the ancient crooked stick for a plow, instead of the modern gang, as to expect to get the highest price for his crops marketed through the nondescript steer.

The propensity to get something for nothing is strong, but when it leads the farmer to sell his feed—the products of his farm—to animals lacking quality, he is deliberately disregarding the plain lessons of experience for a mere chance.

It has aptly been said, "that no mechanic can do his best without the tools adapted to the work in which he is engaged," and no man can fatten cattle successfully unless the animals have been bred with due regard to their feeding qualities.

I have here a few illustrations of breeds and types of farm animals that may more clearly impress upon your minds some of the points I wish to make.

Every farmer should have a definite plan and purpose in view in connection with every farm operation or undertaking; for instance, when he starts out in the morning for his day's work, he takes certain tools or implements with him. It may be a plow, a mower. a harrow, a binder or other tool or implement. The kind of work to be done that day determines which it shall be. He does not take the plow into the wheat field to harvest wheat; neither does he take the binder to the field to plant or plow corn. He takes the implement or machine with him required to perform the particular work he wants done. He knows what is to be done and the implement or tool required to accomplish his purpose in the best and most economical way. Now why should the farmer make any greater mistake when he determines to use live stock in connection with his farming operations than he does in the selection of the proper implements for the cultivation of the soil and the harvesting of his crops? There are just as wide differences in the use and adaptibility of farm stock to certain ends or purposes as in the various farm implements.

If we study the history and characteristics of the numerous breeds and types of animals, we find that they have been developed by selection, feed and care for various specific and special purposes, and that we now have animals especially adapted to all of our various requirements—animals that have been bred along certain lines for the accomplishment of the most economical and best results until the habit has become absolutely fixed and can be transmitted to their offsprings.

If the farmer desires to convert the products of his farm into mutton, he should seek the breed of sheep that have been developed for this particular purpose, and not attempt to make mutton out of wool-growing sheep. If he desires to convert the grass, hay and grain of his farm into dairy products, he should select the cow that has been bred for dairy purposes and in which the conversion of this food product into milk in the most economical and paying quantities has become a fixed habit. We have on the chart an outline of a beef steer, showing the manner in which the carcass is cut for the wholesale trade. It shows their different cuts, their apportionate weight and price per pound. It will be noticed that three of the cuts, viz: the prime of rib, the porterhouse and sirloin together constitute about one-third the weight of the dressed carcass of the steer. But if you put the prices of these three cuts together you will find it equal to the value of the remaining two-thirds of the carcass. Two-thirds of the value of the animal is represented by the three parts or cuts referred to, while they only constitute one-third of the weight.

The lesson to be learned from this fact is that if we are going to feed cattle for the purpose of making beef, it is important that we feed the kind that will put as much as possible of the product of the food consumed on their backs where the valuable cuts are.

The dairy-bred steer will consume as much food as the beef-bred steer and perhaps make as large gains, but he fails to convert it into as valuable a product. This fact was abundantly proved some years ago at the Iowa Experiment Station with a Hereford and a Jersey steer. Fed the same food for the same length of time and under the same conditions, they made practically the same gains and were shipped to market and sold the same day; the Hereford sold for $2.22½ per cwt. more than the Jersey and consequently paid more per bushel for the corn or grains consumed. The question may well be asked:

"Why should they not sell for the same price per pound?"

When these steers were dressed it was found that there was 10 per cent more beef in the Herford carcass. The Jersey had 190 pounds of loose tallow and 55 pounds of suet on a 763-pound carcass, or in other words, 32.1 per cent of the Jersey's carcass was tallow. Tallow at the time of this experiment was worth 4 cents a pound, while the best loin cuts were worth 19 cents at wholesale. The Hereford had only 95 pounds of tallow and 38 pounds of suet on an 888-pound carcass, equivalent to 15 per cent.

We have here two steers that have consumed practically the same amount of grain and feed and cost the same when ready for market, and yet one sells readily for nearly $30.00 more than the other. The wide difference in value was not caused by the care, the feed or the market, for they were the same; therefore it must have been in the animal machine. The Hereford converted its food into a higher priced product than the Jersey. The one was a better beef machine than the other. The question was asked in the hall yestereay:

What feed can be given to the Holstein cow in order that she may produce Jersey milk?

This question suggests another: What feed can be given a Jersey steer that will enable him to produce Shorthorn, Hereford or Angus beef?

I read a story a short time ago, of some fellow over in France, who had a very peculiar animal that he was exhibiting as a great wonder and curiosity, and the people were flocking in crowds and paying their money to see it. Things were working along finely for the fellow and he was coining money out of the scheme until one day a dog came into the presence of the strange animal—immediately the animal's back humped and it began to hiss and spit—the mystery was solved; it was a shaved cat. Now why did that cat do that thing in the presence of the dog? Simply because it was a habit acquired by its ancestors away back hundreds of years ago. It could not help it.

You can feed the Jersey identically the same corn that you feed the beef breed animal, but it does not produce the same thing, and why? Simply because the Jersey's ancestors acquired habits away back years ago, of doing something else with the feed consumed—of condensing it into milk or butter fat instead of flesh, covering the bones and rounding out the body. That has been the idea and the purpose for which the Jerseys have been developed for so many years. The cow that showed a disposition to produce more and richer milk than another was the one that was kept to increase the herd. An improved milk-producing machine was sought and not a beef-producing machine, and the Jersey steer can no more help converting its food into internal fat, tallow and suet, than the cat could help humping its back and hissing when the dog appeared. It is a habit that has been acquired by long years of selecting, breeding and feeding with a particular object in view.

The farmer who uses animals of any kind and for any purpose, should be just as familiar with the kind of machine they are. what he can do with them, what article or articles he can manufacture in paying quantities from the raw materials grown on the farm, as he is with his plows, harrows, cultivators, or binders.

When I call attention to this animal on the chart it is immediately recognized by those who are acquainted with the uses and purposes of the various breeds and types of animals, as a beef making machine, or more definitely, an Angus beef making machine. The next is the Shorthorn beef making machine. We also have the Hereford and Galloway beef making machines. They are all for the same purpose, just the same as we have the McCormick, Deering and Plano binders--you pay your money and take your choice, but always remember that you can do well but one thing—the particular thing for which the machine was made. Our binders were not developed in a day.

They have been twenty-five or thirty years in being brought to the condition in which we now have them. I presume that not a year passes but some improvements are made on these machines just as we are striving to improve our cattle.

If we are interested in growing beef and have in our herds animals that take on flesh more rapidly than others, or are inclined to mature at an earlier age, we should keep the produce from those animals in order to perpetuate and improve upon those qualities. The thing we are trying to accomplish is to get the most money for what we grow on the farm—the hay, grass, corn and grain. If one animal will convert that feed into a more paying product and in a shorter time than another, that is the animal we want. That there are wide differences in the capabilities of the various breeds and types of animals there can be no question, but the many misuses and futile attempts at stock raising in Illinois abundantly prove that this question is not as well understood as it ought to be.

Every farmer should have an ideal—a something in his mind towards which he is working or striving for, just the same as the artist who undertakes to make a fine picture. Beautiful paintings are not the result of accident or chance, but of thought and study. If the farmer is going into the beef business he should have the beef form like the model on the chart—even trimmed, low, broad, deep and thick with parrellel lines top and bottom; such animals are modern, up-to-date beef making machines, and will pay the highest price for feed consumed.

President Wyman then introdcced Hon. L. H. Kerrick, of Bloomington, who spoke upon the

CARE OF CATTLE.

In discussion of the theme I have in mind Illinois conditions. Of course many things that may be said on the care of cattle will be found to be in point anywhere and any time.

L. H. KERRICK.

CALVES IN GROUPS.

Let us begin with the young calf just come into the world. It has been bred for beef. It is dropped in the springtime.

And here I might observe that in the care of a herd of beef cattle, it is desirable to have the calves come in groups. It is undesirable to have them scattered along through the year. This for many good reasons.

THE ADVANTAGES.

First, it is only by this means that uniformity in size, weight and age can be obtained for your bunches of cattle.

It is better to have your calves come in two groups—one in the spring and one in the early autumn.

You will be enabled to get along with a less number of bulls in this way.

You will not have so many cows with full udders to look after at one time.

This method will furnish you steers that can go either as long yearlings or short two or long twos, etc.

That is you will have cattle of such ages and weights as will give you widened opportunity to meet the peculiar demands of the market for light, medium and heavy weights, etc. Your bunches of calves will not be too large for convenient and successful handling.

One should avoid having his calves come in the hot summer months and during the height of the fly scourge.

Going back to our young calf—if a bull, I would practice castrating as soon as the calf is strong enough to nurse well and trot about after its dam. Choose a favorable day or hour for this operation. If the weather be warm, wait for a cooler day or work in the morning or evening. Do not trust this nor any work in connection with your cattle to a careless or unskilled or unkind hand.

AT CALVING TIME.

There is no better place than the open pasture, in proper season, for the calf to be born. The pasture should be sufficiently large to accommodate not more than about twenty mothers. This is as many cows as ought to be running together and having calves.

DAILY CARE OF THE COWS.

You will not be able to see over or get over a large pasture often enough, or to see and care for a large number of cows bringing calves, as often as you should.

It will be well if your pasture can be located near your home or the home of your herdsman.

No day should pass without seeing your cows two or three times within the day.

There should be no open, muddy bottomed ditches. There should be shade, either of trees or shedding. The fence should be good enough to confine your cows safely, and to effectually exclude other stock.

EXCLUDE HORSES

Never permit horses of any kind or age to run with your cattle. They do not mix well. The horses will dominate your cattle—they will tear through the herd recklessly, sometimes viciously—they will fight them away from the watering place. Your cows will live in fear of the horses. A good cattleman will not put horses among his cattle. The pasture should always furnish a good bite of suitable forage for the dam.

Calves will do well running with their dams until near weaning time, or they will do well if taken from the dams and confined in a suitable paddock or pasture adjoining the pasture where their mothers run, permitting the calves to suckle twice or three times a day.

SEPARATING THE CALVES.

We prefer separating the calves from their dams after they are, say two or three weeks old. The calves will learn to eat grass probably sooner in this way. Certainly it is easier to teach them to eat concentrated feed. It is believed this practice improves the milking capacity of the dams. The udders have time to fill up and develop, if the calves are permitted to suckle twice or three times a day only. By this method also you will get better acquainted with your calves; and if you are gentle and handle them gently, you will have your calves gentled sooner. You will get better acquainted with the cows also, and they with you.

TEACHING CALVES TO EAT.

Before weaning, calves for beef should be taught carefully and perfectly how to eat concentrated feed. The feed should be in good variety, and prepared and presented in a way suited to their tender age. Calves so educated and handled will suffer no loss or shock when the weaning time arrives.

It is easy to handle calves, following this general plan in such a way as to avoid all disturbances of temper and thrift of both dams and calves.

PREPARING FOR WINTER.

Now say that we have arrived and passed the weaning and the winter is coming. Twenty or thirty calves or even a somewhat larger number may be nicely and successfully wintered in a pasture lot of eight or ten acres.

THE SHED.

There should be provided some adequate shelter, which need be no more than a well roofed shed enclosed at each end and at the north side, to which might be added a tight board fence six feet high and forty or fifty feet long, extending southwesterly from one of the west corners of your shed.

I am wintering sixty calves in a shed of this kind, except that for this winter we have boarded in the south side also, with doors at east and west ends.

The high tight-board fence at the west prevents a violent draught pouring into the west door if open. But precaution may be taken to close this west door when weather conditions require. Coming close up to the west side of this shed of which I speak is a big cornfield. The cornfield also extends on the north side and not far from the shed, affording a fine windbreak for the calf shed and its little pasture. These calves are fed twice a day a suitable ration. They are encouraged to eat plenty of good and suitable roughage.

SMALL SHOATS FOLLOW CALVES.

We let some hogs follow these calves. I would rather not, if we could save some waste by any other method. But we do not, or at least should not, have any large or old hogs in with the calves. Small shoats are the kind to use. Hogs disturb the bedding and occupy the better parts of the shed and get in the way of the calves, in their shed, and I presume the shoats think the calves are in the way.

PREVENT THE MUD.

We might shut off a part of the shed for the hogs, and this we generally do in our longer sheds. If the calf shed can be located on a well drained spot, so much the better. The shed and immediate surroundings must, if possible, be kept dry and free from mud. A wet, muddy shed with muddy surroundings works strongly against the thrift and comfort of your calves. If the roof be good, so as to keep the bedding dry, you will be able to keep your calves comfortably bedded with far less straw and less frequent change.

CLOSE HOUSING NOT NECESSARY.

Close housing of calves or cattle of any kind in this latitude can not be proved to be necessary or practicable. A dry bed of straw to lie upon, and adequate protection from winds, cold rains and driving storms, comply with the nature of otherwise well kept cattle. With such provision, they will be comfortable and will thrive even better than with very close housing.

Speaking of hogs, I might have said that none should be allowed in the pasture we first spoke of, where the calves were running with their dams or where they were being dropped.

SHALLOW TANKS.

I have often seen watering places provided for calves, tanks—etc., which were far deeper than necessary, and I have seen the calves struggling to get water that was too low for their convenience, while there was still water in the tank available for a full grown animal.

When the winter is past and the spring is coming, with its occasional warm days, the heifer calves and the steer calves should say goodbye to each other and part for good.

TWO GROUPS AND DIFFERENT TREATMENT.

It is not practicable to herd them together longer. The steer calves being intended for beef might stay-in the small pasture or go to another, but their feed is to be not only continued regularly, but increased gradually to what we are accustomed to call "full feed," and the process kept up so until the steers are sold for beef in the market.

THE HEIFER CALVES.

The heifer calves may be tapered off their feed, and for first summer they will do as well on good pasture, or at least it will hardly be profitable to give them more than good pasture until winter time, when they ought to have whatever of grain or roughage may be needed to keep them in good strong hearty life and flesh, of course not having in mind to make them fat, unless indeed you are proposing to fatten them like the steers for beef, in which case you would have kept on feeding them from the first the same as the steers.

Heifers intended for breeding should have sufficient feed of proper kind at all times, to support their normal growth and development until of full age, size and development.

UTILIZING ROUGHAGE.

After that period has arrived, a cow herd may be required to utilize all sorts of forage and feed here and there about the farm, summer and winter, and they may get a large part of their maintainance out of such things as could hardly be ground up or baled or made marketable or profitable in any other way. The cows may be your gleaners, we will say, saving many things that could not be otherwise saved or used. Heifer stock feeds for beef and very kindly, even better, if anything, than steer stock.

HEIFER BEEF EQUALS THAT OF STEERS.

What experiments we have made go to prove that a heifer will make as much beef, and as good, and quickly, as a steer, with the same amount and kind of feed; the advantage being rather with the heifer. And I think this can be said of open heiefers, and I think it can also be said, I believe, of open heifers, that with as little attention as occasion may arise, due to the nature and instinct of the open heifer, that she will feed as well, that is, make as much beef in as short time and of as good quality. as the spayed heifer.

SPAYING UNNECESSARY.

Such information as I have leads me to believe that spaying is an unnecessary and cruel practice; that nothing is gained by it, and probably something lost. I recall not very distinctly all the facts in the connection, but as long as twenty or twenty-five years ago an English society for the prevention of cruelty to animals, promulgated the statement that spaying heifers was cruelty to animals, being unnecessary and unprofitable.

CARCASSES AT INTERNATIONAL.

Many here will remember a magnificient load of spayed yearling Angus heifers exhibited in the recent International Exposition by one of our most successful breeders and exhibitors.

Returning to stock yards the week following the International Exposition, I inspected the carcasses of these spayed heifers along with the carcasses of other prize-winning loads that had been shown in the exposition. There were hanging thirty halves of spayed heifers, beautifully dressed, carrying all the fine characteristics of Angus show beef. But the whole display was marred by a hideous, even repulsive scar on each carcass, right in the loin, where should be found the finest, high priced and most toothsome beef.

But the exhibitor was required, as I understand it, by the rule of the exposition as it now stands, to spay these heifers if he would exhibit them in the class he desired.

IN MARKED CONTRAST.

Again, in the same establishment and on the same day, hanging near the spayed heifers, I examined the carcasses of another load of yearling Angus heifers that had not been spayed. They had been shown in a class not requiring spaying.

Hardly anything could have exceeded the beauty of these thirty halves of the unspayed heifers as one glanced along their even lines, smooth exteriors, no scars, nothing but nicely covered, thick, smooth, attractive carcasses of the very highest quality and which I can not have a doubt yielded their feeders returns of beef for the feed used equal to it if not exceeding those coming to the feeder of the spayed heifers.

FEED ONE OR TWO CAR LOADS.

Two carloads of cattle fed together will be made to do better, I am convinced, than any larger number, though a much larger number can be made to do very well. I would rather feed one load than any other number. What I have said about the calves as to shade, shelter, bedding, etc., etc., will be generally applicable to feeding steers, and indeed to all the herd.

In summer feeding it is quite worth while to do whatever you can without too much trouble or expense to protect your cattle from the fly scourge, and your calves too.

COOL, DARKENED BARN.

It is frequently easy to find on the farm an unused shed or barn that can be darkened and kept cool and well ventilated for this purpose. Nothing will be more apppreciated by your cattle than protection from flies during the height of the fly season. We have two barns, quite inexpensive for their size, that are built to hold forage above, with room for cattle below. These barns are painted white. The color or lack of color, and the smooth surface, serve to reflect the sun's rays and to keep down the temperature inside.

We arrange to darken these barns, giving ventilation of course, so that our feeding steers especially may have the chance to escape at will from the flies.

CURTAIN BRUSHES FLIES OFF.

The thing is done by darkening windows and closing doors, leaving one way of entrance, and that curtained down close to the ground, the curtains hanging loose. When a steer gets tired of the flies he simply walks into this cool, shady place, and as he goes the curtain wipes the flies off his back. We have practiced this for many years and could not afford to abandon the practice.

ANOTHER FLY METHOD.

Something can often be done for protecting your cattle from flies by the lay and arrangement of your pastures.

If you have a pasture on the south and west sides of which there are grain fields or any kind of fields in which there is no live stock; and if the larger part of your pasture is free from shade trees or other shelter for flies; and if you will put your feeding place and watering at the north end of this pasture; and if you will watch your cattle next summer, under these conditions, you will find them during the fly season seeking the south end of the pasture every day, to lie or stand there most of the time.

That is, provided you have no such darkened shed or barn shelter as I have described.

THE PHILOSOPHY OF IT.

The philosophy of it all is this: In Illinois, during summer, the winds prevail largely from the southwest. Your cattle will start after feeding and drinking in the morning, and after the sun is hot, southward across your pasture. When they get away from the feeding place and out in the hot sun with generally a southwest wind, the flies will leave the cattle, returning to the shed and watering place and whatever protection is thereabout. They know the cattle will come back for shade and water and they do not like the hot sun nor the wind. Before the cattle get to the south end of the pasture, if it be a quarter of a mile or so, they will be about free from flies. Finding themselves free they will stay in that south end of the pasture.

I have provided, you will remember, that there be no live stock south and west of the pasture to furnish another supply of flies.

HOW IT WORKED.

In a pasture like this, which was a half mile long, and in which I used to feed a hundred or more cattle right along through the summer, and along the south side of which there was a big hedge, I would find my cattle lying quietly along this south line hedge all through the middle of the day in fly time, with scarcely a fly in sight about them.

CREATURES OF HABIT.

Cattle are creatures of habit. They come under the influence of habit as easily as man, and they have no will to break either a good or a bad habit. They will soon establish a good habit like that I have just mentioned. On the contrary, if you have a field adjoined by others in which there are cows or horses or other stock moving about, or in and out of which you are frequently moving cattle, you will find your feeding steers will soon contract a habit of standing along the fence next to the other cattle, and no matter what the weather or what the conditions as to flies and other things, your cattle will be found along this fence rubbering at the other cattle and pushing about and doing almost every other thing but attending to their business and making good beef for you as fast as they can. I have had steers I was trying to fatten get such a habit of standing along the fence to watch what the other cattle were doing that we could hardly get them up to their food at the proper time. They would rather rubber than eat.

PROMOTE HABIT OF LYING DOWN.

If we propose to give our cattle good care we will need to look after their habits and try to have them form good habits instead of bad ones. I think the habit of lying down a good part of the time can be encouraged and promoted in steers feeding for beef. I never feel that I have them coming just right until I find them lying down much of the time.

And when a bunch of steers are found lying quietly, there ought to be very good reason to justify arousing them. If it is at all convenient for your visitor to wait, have him do so until it is convenient for the steers to get up of their own accord.

A MAN WHO HAS MUCH TO LEARN.

I have seen one claiming to be a cattle man—"oh, yes, he had fed steers before you were born"—ride to a bunch of nearly fat steers all lying down quietly, and with his buggy whip strike them smartly here and there, scarcely allowing a frightened steer half time to arise in a dignified and beef-making way. Such a man has very much to learn in cattle business and is not very likely to learn much more. The whole proper care of cattle may be summed up in this: Make them comfortable and keep them comfortable, in mind and body. It is so well worth your time.

DON'T FRIGHTEN THE CATTLE.

Cattle are easily frighfened, and there are many things that frighten them and fill them with apprehension. They cannot and will not thrive except they feel safe, satisfied and comfortable.

We have often been complimented on our success in gentling our cattle. We do not take much pains to gentle our cattle. We take great pains to do nothing to make them afraid or suspicious of us. It follows then that the cattle of themselves become gentle and confident that they are safe in our hands.

The pigs about the feet of the cattle do nothing to gentle or tame them, and yet the cattle are not afraid of them; but the pigs do nothing to frighten or hurt the cattle, which the steers find out and then they are not afraid of the pigs.

MAKE FRIENDS WITH CATTLE.

If, after avoiding every cause of fright and apprehension on the part of your cattle, you take a little pains to make friends with them, you get on very rapidly.

In a bunch of forty or fifty steers that have never been handled or touched with the human hand, it need not be more than a few weeks until nearly all of them will stand for you to scratch or stroke their backs, and every bunch will develop a few that will follow you about in order to receive your caresses.

Now and then there is a steer that can never bring himself to the point of permitting you to fondle him or to scratch him, and these are sometimes very fine steers.

When you have discovered such a one, have regard for his mental constitution; he can not help it—he is simply overcautious and suspicious of human kind.

Keep a respectful distance from him; do not push your company on him; but you will never meet and touch, and you and the steer will have to go through in that way.

MOVING THE CATTLE.

In changing the cattle from field to field there is not a bit of use to choose a stormy day or the noon hour of a hot day.

Do such things in the evening or morning, the preference being for the evening. Cattle put in a new field in the morning, whether it be a stormy day or a hot day, are likely to spend that day exploring their new surroundings.

If brought to the new place in the evening, I think they are more likely to rest in the place you put them, until morning, then some of their curiosity will have vanished.

HAVE A HERDSMAN WITH THEM.

When cattle are brought together that are unused to each other and placed in the same field, no thoughtful cattle man will leave them at once, but will stay to check too much hustling and banging around while getting acquainted with each other. The herdsman needs to be there, and ought to be, to introduce the cattle to each other.

DRIVE CATTLE SLOWLY.

I have often had great trouble getting my men to drive cattle slowly enough. Beef cattle scarcely ought to be driven at all.

Keep them headed in the direction you wish them to go and permit them to take their own sweet time in going. If fat, and going to the station to be shipped, they ought to go along so slowly and so much after their own inclinations that they will hardly know they are going at all.

THE ARITHMETIC OF IT.

Suppose you have two or three miles to go with two or three car loads of very fat cattle. And suppose two men spend five hours getting the cattle to the station. This will be equal to one day for one man, or a dollar and a half in money. Suppose you drive them up and make three miles in an hour and a half. You would save a dollar in the wages of your men and in all probability lose fifty the next day when you sell your cattle, on account of extra shrink, loss of bloom, etc.

RAISE SOME CATTLE.

Some cattle men, and a good many of them, will hardly believe that we can afford to raise cattle for beef on these high-priced Illinois lands any longer. I will not discuss that question. We may be sure that we will have to save every point. The breeding must be the best, the feeding the best and the care the best, if raising and feeding cattle for beef can be continued with profit here. On the other hand, it is an equally serious question, can we afford to give up the business of raising cattle for beef in Illinois and depend entirely upon the ranch and range for our supply of feeders? We might find it, on account of enhanced prices for feeders, equally difficult to buy our feeders and make a profit out of feeding them. I am inclined to believe we would better keep on trying by the best known methods to raise at least some part of our beef cattle.

KEEP UP THE BULLS.

A matter which I ought to have mentioned in the beginning of my paper, but overlooked: For a general practice. I would not allow the bulls to run with the herd. I think it is better to keep them up, using them only when the occasion arises. In the grade herd, especially in a herd of some considerable size, it is hard to keep any record of the cattle, yet such records as you may keep will be found valuable. It is easy to record the date when you began breeding and when you quit for the season. Or, if for any reason the bull is not used for a few weeks during the season, a careful record of that should be kept. By this, you will be better informed and more certain as to when your calves should be coming and all that.

KNOW THE COWS INDIVIDUALLY.

Where one has a small herd of grade cows, it would not be difficult to know each cow individually; nor would it be much trouble to give each one a name and number and keep a book or record of it. Then wherever there was a mating why not record that, the name of the male, the date of the mating, the name and number of the cow? And when the calf comes, give it a name with the date of its birth and a number?

You would know when to look for the coming of each calf, and wouldn't you be quite apt to note whether or not it is a good one? And then if you preserve its name and number in your book, knowing what dam it came from and what sire got it, you know whether to keep that cow or not, and whether or not to keep on mating that bull with that cow.

WHAT A RECORD DOES.

It is only by the record that we can prove our cattle. Now and then a magnificent steer appears in our grade herd, which I will say is what might be called a large herd—nothing could beat him. But when this fine steer is mature, and two or two and a half years old, nobody knows where he came from nor his dam nor his sire. We do not know how to repeat him. Nothing but a record will enable us to repeat that steer; that is, to get a full brother or sister to him again.

We are liable to part with his sire or dam, not knowing what we are doing, because we do not know his dam nor his sire if we are using more than one bull, which is always the case with us.

PRIVATE RECORD FOR GRADE HERD.

I think it not improbable that many men who have small herds of grade cattle and are trying to raise their own steers, will find themselves one of these days keeping a private record of their herds and their performances. It is only by the record that cattle have been improved. The breeder of grade cattle buys a recorded bull and uses it in his herd to improve it as much as he may, but no credit is due the grade breeder except that he has had good judgment enough to buy a bull from a man who is using the only methods of improving cattle. The improvement in your grade herd is due entirely to the efforts and the care of the man who had the pure bred and recorded herd and sold you the bull.

A Delegate—You stated, concerning those heifers that were hanging on the hooks, that they were excellent; almost the finest beef you ever saw. Were they equal to the steers that were raised with them?

Mr. Kerrick—No. Nobody claimed they were.

A Delegate—Was the beef as good as the steers of the same quality?

Mr. Kerrick—I don't know, if they were spayed.

A Delegate—Take the open heifers.

Mr. Kerrick—I believe that would be.

A Delegate—Why the difference in price?

Mr. Kerrick—Ask the fellows that bought them. In Europe it is not so. There is no such difference.

MRS. S. NOBLE KING,
(President Association of Domestic Science.)

GENERAL SESSION, OPERA HOUSE, 2:00 P. M., FEB. 22.

ILLINOIS ASSOCIATION OF DOMESTIC SCIENCE.

President Mrs. S. Noble King presiding.

After a musical number by a class of young ladies from the Joliet Training School, under the direction of Prof. J. M. Thompson, supervisor of music for the Joliet schools, the president introduced Miss Sallie Anthony of Bloomington, secretary of the association.

MISS ANTHONY'S REPORT.

The seventh annual meeting of the Illinois Association of Domestic Science marks the close of six years of earnest work for the women and girls of Illinois and the homes which they represent. From the reports that have come to us and the range of subjects discussed, as shown by the programs, we feel that the primal objects of the Association, "to stimulate an interest in home-making and to labor for the introduction of domestic science into our educational system," have not been lost sight of. From teachers and clubs are coming requests for suggestions. We have offered Miss Isabel Bevier's suggested course of study for rural schools and books from our own library.

MISS SALLIE ANTHONY,
(Secretary Association of Domestic Science.)

The people of Illinois are waking to the fact that a closer union between home and school will be established by the introduction of domestic science in the school. Prof. Frank Hall, State superintendent of farmers' institutes, has gone up and down through the State urging the people to choose an education which will make them useful members of society. He says: "Let usefulness be the criterion for the selection of a course of study," and the motto is equally applicable to boys and girls.

We were glad to find that domestic science was included in the "course of study" for the public schools of Illinois. Many teachers are anxious and willing to take up the work—uncertainty of methods is the only hindrance. Orion, Henry county, sounds the keynote in the following resolutions:

WHEREAS, The Orion Domestic Science Club finds in the course of study for Illinois public schools an outline for domestic science work to be taken up by said schools, and

WHEREAS, It is one of the principal objects of this organization to introduce this study to the schools; be it therefore,

Resolved, That we beseech the teachers of the Orion school and of all the schools in the township to introduce such work into general exercises in the lower grades and into the physiology and chemistry classes in the higher grades; and, be it further

Resolved, That we beseech the teachers to emphasize the sacredness of the body and the proper care of a healthy body; and, be it further

Resolved, That the teachers are invited to attend the meetings of the domestic science club.

GRACE F. LOVE,
GERTRUDE BAKER,
Committee.

In Lewistown, Fulton county, a room in the school building has been equipped and many girls are anxious for a special training offered through the zealous efforts that have been put forth by these earnest women.

The Auburn club, Sangamon county, gained the consent of its high school board to introduce the subject, but McLean county claims to be the first in Illinois to begin the teaching of domestic science in the country schools, and the county teachers' institute was the first in the State to offer an hour's instruction in domestic science every day of the institute by a competent instructor. The county superintendent, in summing up results of the teachers' institute, says in his paper: "We have learned that domestic science is not narrowed to the mere matter of cooking, but that it pertains to all that contributes toward healthy, happy, prosperous home-making." Now with these few of the many instances, and the normal training possible through the effort of the trustees of the Illinois State Normal University in the installing of a well-equipped department of household economics, the highway to the success of one of the objects of the association is open.

While several counties do little save in providing a program for one session of the annual county institute, the majority arrange programs for a year's meetings—monthly or bi-monthly—and a remarkable improvement is noted in the programs received by the secretary. Cass, Brown and Washington have exceptionally good programs. One feature of the Edwards county program is commendable. Four clubs of the county are doing uniform work. The same arranged printed program is used in all.

Considering the fact that the county work may be somewhat scattered, the officers of the association have recommended that "Home Culture clubs" be formed in each school district—a club to which parents, teachers and pupils may belong. In Winnebago county a home culture club was organized for girls and prizes offered for needlework, and other prizes for bread, the latter to be judged by the household science score card. In providing this contest it is hoped to do for the girls what the corn contest does for the boys. But be it said the corn contest has in some instances included the girls as competitors.

Requests that come frequently to the secretary are for suggestions for work, topics for study, ideas for programs. A correspondence course in domestic science has been recommended, after careful examination by our president, and letters were sent by her to the presidents of clubs calling their attention to the course and asking their consideration of the matter and of the circulars to be sent to them by the director. Some have been debarred on account of expense, others are favoring the idea. The need is felt for a definite line of study.

The department of household science at the University of Illinois has had a great increase in attendance. A very large number of young ladies have accepted the free scholarship given to counties having associations of domestic science. Mr. Pillsbury, the registrar, writes: "Some changes are contemplated by the trustees. This, however, I can say, the privilege will doubtless be extended and certainly not be diminished." Of the sixty-four enrolled in the household science department last semester, fifty-three had scholarships. Let it be the aim of every president of a country association to see that her county is represented by an appointee every year, as it is her duty and privilege to do.

That the Housekeepers' Conference, which was established four years ago, at the University of Illinois, has not been to the State all that was hoped for it, is a source of regret. In order to stimulate more interest, we had printed in June, 175 circular letters, from Mrs. O. H. Swigart, Urbana, Ill., president of the Housekeepers' Conference. These were addressed to the presidents and secretaries of county farmers' institutes, calling their attention to the conference and urging them to secure the appointment of a representative woman, who would attend the conference, and on returning would make a special feature, at the farmers' institute, of the lessons learned there. Thus, a greater number would be benefitted. These letters were sent to reach the addresses within one week of the time of the institute session. In December it was decided to omit the conference on account of the great increase in the number of students in the household science department of the university. Consequently notices to this effect were sent out. Later the matter was reconsidered, a program arranged, of which 1,500 copies were printed, and the conference was held the last two weeks of January as usual. The programs were mailed to 600 names on our mailing list, and a number were distributed by Mrs. Swigart, Professor Hall and Mr. Rankin.

Of the 106 in attendance, sixty-nine came from Champaign and Urbana, nine from the county, and only twenty-eight from the State at large.

The sixth annual year book of the Association of Domestic Science of Illinois was published in June, 1904. Twenty-five hundred copies were printed and distributed as usual to members of the associations whose names appear on our mailing list, to officers and directors of the State Farmers' Institute, and to many requesting copies. From New York, Boston, Ohio, Indiana, Iowa, Missouri, Kansas, Idaho, Minnesota, North Dakota, California and Tennessee, and from Quebec and Ontario, Canada, have come requests this year. To all these we have cheerfully mailed copies. In October our association was represented for the first time in the National Congress of Farmers' Institute Workers, at St. Louis. Mrs. S. Noble King was the chosen delegate and ably presented the work of the association. Mrs. H. M. Dunlap of Savoy, was present and talked of the "State Fair Cooking School." Minnesota, Maryland, Indiana, Illinois, Wisconsin and Ontario had representatives of "women's institutes." It is a matter of local pride that Illinois is in advance in organization and work accomplished. Perhaps the sentiment aroused in this meeting will result in a national association of domestic science.

At the close of a very enthusiastic session in charge of the women representing these states, Secretary Creelman suggested that the women form a permanent organization in connection with the American Association of Farmers' Institute Workers, and in compliance with his suggestion, a meeting was called to consider the question. It was decided that a separate organization would not be advisable. So a committee of five was appointed to arrange a program for a session at the next meeting. Our own Mrs. Carter of Champaign, is the chairman of the committee.

Through the kindness of Mr. Hostetter, secretary of the Illinois Farmers' Institute, we have received sixty-two copies of programs printed for county farmers' institutes. In fifty counties a place has been given to the subject of domestic science. In thirty-four counties one whole session (at least) was given to the subject, and in sixteen others one or more topics were discussed along that line. Eleven gave no time or space to the interests of the home. Only seventeen programs had printed the names of the county officers of the association, and only one included the names of officers of auxilliary clubs,

An earnest effort has been made to secure the organization of every county in the State. That we have not been successful is to be regretted. We have had reports from many but not all the clubs, hence our estimate of progress is not as accurate as we desire, Forty clubs report a membership of 1,607. From this comparison we may estimate a total membership of over 5,000.

Champaign county again leads in point of number of clubs, eight being reported. Grundy county is gaining rapidly; the president writes that a club is being organized in each township, and promises all townships in line before another year. Clay county has six clubs, and the program as outlined for the session of the county farmers' institute was one of the best we examined. Christian county has six clubs; Bureau reports five; Sangamon, Macoupin, McHenry, McLean, Montgomery and Edwards each have four clubs.

A short report from a number of counties will be printed in the year book for 1905.

Fayette, Kane and Knox are counties organized during 1904-5. Ninety counties have organized, and are represented by 150 clubs, most of which are doing creditable work.

President Mrs. King—Yesterday afternoon the question was asked, as it frequently is asked, "What is meant by domestic science?" That is a very fair question, because a great many—I think I may say a very large majority—of the people think it means cooking and sewing only.

Domestic science is the science that underlies the art of right living.

Perhaps we should speak in the plural number, since many of the sciences directly affect the work of the housekeeper.

First, may be mentioned sanitary science, which insures healthful conditions in the home. A home-maker who understands the subject of bacteriology and who has the best interest of her family at heart will not compel them to live in darkened nor ill-ventilated rooms.

The science of nutrition includes not only the nutritive value of food, but its adaptability to various conditions, ages and occupations.

Briefly speaking, we understand domestic science to include all the agencies which go to make a healthful, comfortable and desirable home. Not the least of these agencies is the proper expenditure of the family income, hence we urge all women to make a study of this phase of the work.

When we began this work seven years ago we began it with a two-fold object: First, to improve the conditions in the present-day home; second, to secure the introduction of domestic science into the schools of our State, so that our girls could have a training in the school which they could not have in the homes. First, because they have no time to receive it; second, because in a great many homes there is no opportunity. The first obstacle we met with was a lack of literature on the subject. We have succeeded in getting that to a considerable extent, and yet we are always reaching out for information on that subject and all others that will give us more experience and enable us to do better work along those lines.

We have with us Miss Martha Van Rensselaer, supervisor of farmers' wives' reading course, College of Agriculture, Cornell university, Ithaca, N. Y., and we have great pleasure in presenting her to you.

THE FARMERS' WIVES READING COURSE.

(Miss Martha Van Rensselaer.)

LADIES AND GENTLEMEN—Last evening I explained to you that the farmers' wives' reading course was a part of the extension work of Cornell University, and provided by state appropriation; the same appropriation which provides a reading course for farmers, a nature study course for children and teachers and a short course in the agricultural college for boys and girls if they wish to attend college for twelve weeks of the year. The farmers' wives reading course is not a normal course. It does not aim to train anyone to be a teacher. It does not aim to set forth scientific principles alone, but to help women in the home to be better farmers' wives, to lead them to understand what there is outside of the drudgery of kitchen work and to bring into their lives something that will relieve the monotony. I might say that it has a further motive. I want to read a letter which came from a young man who had been reading the farmers' reading course. He said, "I have a friend to whom I wish you would send the lessons for farmers' wives. Send the whole course, and any other matter that would help to give a city girl some pointers about housekeeping. Any suggestions that you can think of that would help to get her interested in such things would be greatly appreciated." It is evident what the young man had in mind. And if you can make a city girl understand how to enjoy farm life, it is one of the things which is well worth doing.

There is a farmer's wife, who attends the institute and grange, who has the telephone in her home, who has the trolley running by her house, who has the habit of going out and knowing what the rest of the world is doing, who has less need of a farmers' wives' reading course. The lessons are not written primarily for her. There is another kind of farmer's wife. Such a one was called upon. She said that she had been recently married; that she and her husband were living alone upon the farm; that there were no neighbors anywhere near. She made an apology for not being dressed up at 3:00 or 4:00 o'clock in the afternoon. She said, "I did not expect anyone to be along, and I saw no necessity for dressing up." She said that really all she had to do was to keep her house in order; that she never went anywhere; that about the only person she saw during the week was her husband; that he was working on a neighboring farm rather than upon his own and she did not see him except at night and morning. Is there anything to do for the farmer's wife? So we have two things in mind. One to furnish information for the living problem and another to relieve the monotony of farm life. You are all busy upon the farm, and see so much in it to enjoy that you will be surprised when I speak of monotony. But from 5:00 o'clock in the morning until 9:00 o'clock at night, it really is monotonous, unless one has some uplift or something other than work to think of. We have the lonely woman in mind, and also the thousands of girls growing up in the country, who are good material. It matters much what they do in life; whether they settle down and never look beyond the kitchen, or whether they are determined to bring into their side of the home life as much intelligence as doos the man who is studying the balanced ration, and a rotation of crops, whether they will realize that a balanced ration for him is just as important as for the stock.

A short course boy in the college of agriculture, threw down his book and paper with some disgust, and said "I have been studying for three hours about this balanced ration for cattle, and I cannot get hold of it." I had to reflect that the cook in the kitchen had probably not been studying for three hours about a balanced ration for his dinner. Everywhere there is a need of opportunity of preparation on the part of girls for their work in life. Not simply experimenting with household problems after they are presented in a real form, but a training which shall cause home making to become a fine art and a successful accomplishment. When domestic science finds its place it will be taught in the elementary school, in the primary school, in the secondary school, in the high school and in the normal school. And then the college can do its legitimate work. For we believe that sewing and cooking belong to the elementary school, and it is an unfortunate thing, perhaps; that the college has to do what the elementary school is not doing.

While conditions may differ in different states, it is possible to arouse sentiment in favor of domestic science throughout the country, if mothers become interested in domestic science through realizing that home problems are based upon scientific principles. To that end, we feel it is a good thing for a university as large as Cornell University to have a farmers' wives' reading course in its college of Agriculture.

The farmers' wives' reading course consists of three years work. The first lessons are for the home and garden, in which there are taken up the subject of saving steps and of how to build a house in order to make it possible for a woman to accomplish as much with the strength given her as possible. We have considered the subject of the kitchen garden and of the flower garden, and in our second year, we are taking the subjects pretaining to the farm family. We have taken the rural school subject, believing that the rural school needs decided improvement, and believing that the woman in the home is as much interested as is the man in the home. We believe that the woman in the farm home may properly attend the school meeting and have something to say as to whether that rural school shall look like a barn for her children to stay in, or whether it shall be home-like and attractive. We would encourage a woman acting upon the school board where she has so often done efficient work. We have taken up the subject of reading in the farm home, and tried to suggest various books which will help the children in the family to enjoy nature; that they may have not only the nature study books, but books upon farming, so that it will not be desultory work that they will do as farmers.

Our last year's work is in regard to food and sanitation, and that is, perhaps, a little more technical. It is written more for the general reader, than for the actual student in domestic science. The subjects which are perhaps interesting the women most are in regard to making labor easier upon the farm, and yet we have discovered that while the first year they do not care so much for sanitation and foods, they are taking more and more interest in them. I doubt if any class of women in the United States will take up the subject of food values with more intelligence than will the farm women. They sometimes say, "We do not understand the meaning of these terms; we do not know what you mean by protein and carbo-hydrates." We believe that on the whole, the auidence of women upon the farms will be the easiest audience to interest and the readiest readers upon the subject of domestic science; and for that reason I think it is exceedingly fortunate that a body of women like those of Illinois have become promoters of a course in domestic science.

I want to read you in just a few moments some letters from farmers' wives, without reading the signature. I have said that I will never try to present the subject of a farmers' wives' reading course in just a few moments. It is impossible to do it justice. But I am trying to do it today, and I think of no better way to give you an inside view of the situation than to show you the attitude of the women we are corresponding with. (Letters are read.)

We have this year several women in our short course, taking the agricultural subjects, taking the poultry course, the dairy course, all the courses. We have women who own land, who say that as they must be the governing influence upon that land, they must learn how.

I want to say you will be surprised when I tell you that a very frequent request which comes to us is for something to read. The tables in our homes are so crowded with magazines and books and newspapers that we do not know what to do with them. They are too good to throw away. And when a woman writes that she seldom sees a newspaper or magazine, and asks if we can suggest some way to get them, and when she asks with all interest about the traveling library we have there and you have here, you may know there are women upon the farms who will be interested in a course of study and reading. But I would not imply that the farmer's family does not read. We have taken an unusual interest in finding that the farmer's family during the winter months read more, perhaps, than any other class of people. We find that they have more uninterrupted time; that in a city or village there is a theater or concert or sermon or lecture for the people to attend, while the farmer's wife and family have long evenings in which to read and think. Organizations like this have increased and are doing a great work, and men and women in the farmers' organizations are standing shoulder to shoulder and working together in one good enterprise. It means popular education. And while we encourage the study in colleges we will in the meantime work to promote home study, believing there will be a response which will help to give the children more extended courses in the schools.

President Mrs. King, with appropriate remarks, then introduced Mrs. Gertrude C. Sober, instructor in household science, University of Illinois, Urbana, Ill.

MRS. SOBER.

The Proper Expenditure of Energy in the Home.

Should our grandmother visit us today she would exclaim: "Do you mean to say you are busy! Why, I had eight children, I spun all the yarn, wove all the cloth for the family; not only this, with the help of my daughters, the cloth was made into suits for the men, dresses for the girls; coats, overcoats and underclothes. We knit the socks and stockings, mittens and gloves. Yes, and we never bought our bread, and we always preserved all the meats, fruits and vegetables for our winter's use. Now, you no longer see the spinning wheel in the corner by the fireside, nor hear the throbbing shuttle in your quiet home. You buy all your cloth and never think of making your husband's suits, overcoats, and seldom the boys' suits. You often buy your dresses, coats, and underclothes ready-made; your stockings, gloves and mittens. I know those who buy their bread, pies and cakes, all their canned fruits, vegetables and jellies. Why is it you are so busy and sometimes on the verge of nervous prostration?"

Let us glance at the surroundings of these two women. In the home of fifty years ago we have an example of the industrial unit. The home was the center of the industrial interests of the family. The factory system, with its attendant division of labor, has wrought a great change, and its effect we see in the changed conditions of home life. Fifty years ago the life was a simple one. Though the industrial activities were more exacting, the superficial demands were less.

With the division of labor we have a parallel in the division of the house. Where there was one living, sleeping, dining room and kitchen combined, we now have a living room, a parlor, a library, a sewing room, a separate sleeping room for each member of the family, a dining room, and a kitchen, whether the family uses these rooms or not. The division has been made without carefully studying the needs of the family or planning the rooms especially for the uses for which they are intended. Here is one answer to the question why we are so busy—one source of wasted energy.

THE KITCHEN A WORKSHOP.

Though the kitchen is often considered last in planning and furnishing a house, we will consider it first, not alone because it is so important a part of our home today, but because it is here so much energy is wasted. Someone has called the kitchen the heart of the house, since through it pulsates the life blood of the family. It is a workshop, more practically speaking, and should be planned as carefully as its importance demands. It is true the American kitchen is not adapted nor well equipped for the work it is designed to do. Inconvenience, a scarcity of utensils and poor ventilation are common defects. Here we are hampered by past traditions. In too many kitchens we find the remnant of the combined sitting room and kitchen. We want the kitchen to "look well," and so all signs of its true use, the working utensils, are put in a "pantry" off from the kitchen. Count Rumford said: "Our kitchens, as is perfectly notorious, are the fortified intrenchments of ignorance, prejudice, irrational habits, rule of thumb and mental vacuity." Certainly if many women put the same thought and energy on the improvement of home conditions they put on outside undertakings, they could revolutionize kitchen affairs. If we compare the kitchen with other workshops or laboratories, we will soon feel its lack. What would we think of the carpenter who had his work bench (ready for some important piece of work) in a large room. He wants a saw. He must walk ten feet across the room, open a door, and hanging in a cupboard he finds the desired saw. After sawing the board he finds he needs a plane. He must again walk to this cupboard, or maybe the plane is kept in another cupboard, and back to plane the board. So on he works until he has traveled back and forth half a day. If my memory serves me right the carpenter has his ordinary tools in a rack directly above his bench; his less frequently used tools are in a tool chest at the end of his bench. For economy of time and energy we should so plan our kitchen that our working space is not too large and our utensils are at hand and convenient to table, sink and stove.

THE WATER SUPPLY.

In our country homes the water supply in the kitchen is a problem, but not so serious a one as many at first believe. It is certainly poor economy to carry water into the house, and the wash water out doors. We ought to use inert matter wherever possible. The farmer soon finds he is repaid in time and energy by using a windmill and piping the water to convenient places to supply water to the stock. Hardly less water is used in the house, yet how many women simply transform themselves into ordinary iron pipes fifty times a day. This is one of the crying needs of a farmer's kitchen.

KITCHEN FLOORS.

The kitchen floor has worn out more backs than all the other work put together. Here we cling to the past and feel our floor must be white—"clean enough to eat off of," as some one described her neighbor's floor. But floors

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are not intended to eat on, I must remind you. Having had experience with hard wood, oiled, and linoleum floors, there is no doubt but that linoleum leads as a covering for kitchen floors. The colors are bright, its durability is excellent, and for cleaning it certainly is a labor saver.

Cleanliness is the first essential of a kitchen, good sunlight and fresh air. We should so plan the finish that it will catch the minimum amount of dust. A very excellent wall finish is the oil cloth. It is so smooth, little dust adheres and it is very easily washed.

Although we have not the perceptible advance in kitchen utensils we note in the improvement of farm machinery, every kitchen should be equipped with the best the market affords. The limit of this paper will not permit going into detail, but I must speak of the importance of having a good stove. Much energy is wasted worrying over an inefficient stove. As an example of convenient utensils I must speak of a simple invention—the bread machine. Women are conservative and cling to the ways learned from mother. We must advance if we keep up with the procession. The bread machine is so simple to use, yet in some well known instances where the man has taken a bread machine home, the wife would not even try it. There is really no reason why women should be so loath to learn, yet this is only one example of many instances of the clinging to tradition.

Home economics stand for:

The ideal home life for to-day unhampered by the traditions of the past.

The utilization of all the resources of modern science to improve home life.

The freedom of the home from the dominance of things and their due subordination to ideals.

The simplicity in material surroundings which will most free the spirit for the more important and permanent interests of the home and society.

BONDAGE TO FURNISHINGS.

The furnishings of a home to a large extent often hold the housekeeper in servile bondage. Carpets with the attendant house cleaning when the whole family is homeless, should become a thing of the past. In an old house where there are soft pine floors, with little expense the floors can be cleaned and treated with some hard finish like japalac, or, better still, a veneer of oak can be laid over the pine flooring and you have a new floor with little more expense than a good carpet. But even with hard wood floors some make slaves of themselves by having them so highly polished that they require the same care furniture does. This high polish is out of place on the floor. Suitable for furniture, but not intended to be walked on, it hardly stands the test for true art. The question of selecting rugs is not to be overlooked. In all sleeping rooms only small rugs should be used, since they are not needed under the bed. Then they can easily be taken up frequently and shaken out doors; the rest of the time they can be cleaned with a carpet sweeper. Some think if when sweeping a big dust is raised they are doing something. A sweeper does something but keeps it to itself. Avoid heavy rugs, that is, large, unwieldy ones.

STRIKING COMPARISON OF ROOMS.

In selecting furniture we should bear in mind that simplicity is elegance. Morris says: "Simplicity of life, even the barest, is not misery but the very foundation of refinement." Our rooms ought to look as if they were lived in. We should have nothing in the house that we "do not know to be useful or believe to be beautiful." During the housekeepers' conference a year ago, there were on exhibition two types of rooms furnished at about the same cost. One was simple, the furnishings complied with both sanitary and artistic laws; the other was quite the opposite. The one had no "upholstered" furniture to catch dust; the rug was small, extending only where needed; the chairs and table showed good lines, but there were few corners, curves, and twists to catch dust; while the other had upholstered furniture, and cozy corner—an effective trap for dust and the carrier of moulds and disease; the rug was large and extended under the furniture, thus increasing the amount of energy necessary to care for the room; yes, and draperies were hung from the windows over the lace ones to keep out the light and catch dust.

The expense in fitting the two rooms is as follows:

Couch	$15 50	Set of three pieces	$30 00
Table	12 00	Cozy corner	18 00
Rocker	15 00	Table	5 00
Morris chair	14 00	Drapery for cozy corner	4 50
Straight chair	6 00	Drapery for window	3 00
Rug	7 00	Lace curtains	4 50
Curtains	2 50	Rug	12 00
Total	$72 00	Total	$77 00

The same laws hold in supplying the desired bric-a-brac. How many homes give a sense of unrest when you enter! So filled, they are almost a curiosity shop. We should have nothing around of which we become unconscious except on dusting days. Ask yourself "Is my family conscious of this piece of bric-a-brac, or that one?" Do not buy vases because at the time they strike your fancy.

The home is something more than the house and its furnishing. It must have a soul to live. Some homes lack this soul. The inmates eat, sleep, and then are off. Even on the threshold the cold begins to penetrate and you are ill at ease. What is this indescribable, intangible something? We all feel it and know it. There is the same difference between a housekeeper and a home maker. The housekeeper makes housekeeping her chief aim, the end for which she is striving; she spends her energy polishing the nails in the attic floor; she forgets that good housekeeping is simply a means to an end—that end being the making of a home. In order to save energy for supplying the home this intangible atmosphere, she must be equal to her work. Woman's place is unique, her interests diversified. She must "knead bread with energy, mend reuts with cheerfulness, nurse the sick with smiles, put witchery into a ribbon and genius into a stew." She is the business manager as well. To be equal to her work, to be master of the situation, her preparation requires more diversified training than law, medicine, or philosophy. I doubt not many a woman wastes energy simply because she is not trained for the position she is to occupy.

The president of the association then introduced Doctor David Felmley, president Illinois Normal University, Normal, Ill.

DR. DAVID FELMLEY.

DOMESTIC SCIENCE IN THE NORMAL SCHOOLS.

MRS. PRESIDENT—I esteem it a rare privilege indeed to be permitted to appear upon this platform in the presence of this great body of the intelli-

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Dr. Felmley's address followed the address by Miss Barrows, which through the mistake of the editor begins on page 105 of this report.

gent womanhood of Illinois, to discuss this question that has a like interest to the housewife and to the teacher. After listening to the very able discussion which we have just heard, I regret very much that there is no chapter in the Bible that will lend itself to my purpose so well as the 31st chapter of Proverbs lent itself to the subject we have just heard.

Domestic science in the normal school! What relation exists between the work of the normal school and the work of this association? Now normal schools supported by public taxation exist in every state and territory and insular dependency of the United States with the single exception of Arkansas. They exist, too in every foreign nation in which there is a system of education supported at the public expense. We commonly say these normal schools have come into existence because governments have discovered that they can not get an adequate supply of well trained teachers for this work unless the state itself establishes schools that will determine the standard and set the pace. The state that charges itself with public education must see that the education is well grounded, just as much as the state that charges itself with national defense must see that men are trained for the special work in which the state engages.

By investigating a little we shall see that the normal school owes its existence to the same causes that have brought the technical school into existence for every profession or vocation that requires trained intelligence. We know that until recently men and women learned to do through mere imitation. That is, in every craft or trade there was a sort of apprentice system prevailing, and we learned to do what we did a good deal as girls learned to make bread—partly by watching their mothers, partly by listening to their directions, and partly through experience with the batches they spoiled, they mastered the various stages of the process and came to skill in this art.

But all this is changing. We have learned that the highest skill in any art can never be attained through mere imitation, nor by the somewhat haphazard adjustment of means to ends, the failures and waste that we call learning by experience. The highest skill in any business, any art, profession, calling—no matter what it is—can be attained only when we have a clear perception of what the end of that activity is, when we understand thoroughly the laws that control the materials with which we work and the conditions under which we work. Thus it is upon scientific knowledge that the highest skill must rest, and it is to discover this knowledge that the technical school and the professional school and the normal school exist.

Normal schools must grow with the public school system of which they are a part. And I question if there is anything in the development of civilization here in the Mississippi valley, any one line of development, in which we can see better the marvelous progress of our race since it first appeared on these prairies and among the forests of the Mississippi valley, than we can see it in the development of our schools. From the little log school house in the wilderness, with the stick and clay chimney, its teacher of the type of Ichabod Crane, possibly the citizen teacher, who farmed in the summer, and for a few months in the winter gave some of his time to the instruction of his own and his neighbors' children—we know how out of that beginning has come the establishment of our public school system, our improved text books, our established courses of study, our graded schools, our high schools. The normal schools and state universities are at the crown of the entire system. This is the story in brief of the development of this system.

Do you know that there is scarcely a single important line of expenditure in which we have increased our expenditure more in recent years than for education? In 1880 we had over 3,000,000 people and we spent for our schools $8,000,000.00. But during the last year our schools have cost us over $22,000,000.00, an increase of 175 per cent. We are increasing the expenditures nearly three times as fast as we are increasing in population. It is simply because our advanced civilization demands it.

Of what does the advance of civilization consist? Aside from certain special factors, we certainly must say it lies in what we call the division of labor. Man must learn to do his one thing well. We want the efficiency of which we have just heard. No longer can we depend upon primitive methods for securing this efficiency. We depend more upon the school; yet we know that a person never gets the best of his education from the school. We know that the home, the church, the newspaper, the playground, the stage, political life, industrial life—all of these aid the school in determining his habits, his knowledge, his ideas, his character. Yet more and more do we look to the school, and the things learned in the school nowadays, to determine what we shall do and especially to determine how efficient we shall be in what we do.

Many people say, and I suspect there is some reason for it, that our schools are not yielding the service they ought in proportion to their increased cost. I heard it yesterday when talking to the members of the Legislature at Springfield about an increased appropriation for our normal school. They love to say how much better the schools were which our grandfathers and grandmothers attended. I suspect that those gentlemen do not realize that the best of the education that our grandmothers and grandfathers received was not the education of the school at all. The best education they got was the education that came through the use of the hand and the eye, directed by the intelligent brain, in the labor that had to be done on the old-fashioned farm. If a family lives in a flat today in a great city like Chicago, not more than 5 per cent of the labor employed in preparing the house and furnishing the food and clothing, is the labor of that family. But when our grandfathers and grandmothers were boys and girls 95 per cent of the labor involved in preparing the food, shelter and clothing and all the material comforts that entered into the life was performed by the family. And you know on those old-fashioned farms there was plenty to do. It was not machine labor. It was hand labor. The boys had to learn to do a great many more things than the boys have to do now. They raised more kinds of crops. There were more kinds of live stock and more kinds of poultry. These were more common on the farm two or three generations ago than now. More fruits were to be found on the individual farm. The family had to depend upon what was produced on the farm for all the comforts of life.

But now we know that with the so-called progress of civilization our farmers and townspeople alike have learned to sell more and buy more. Activities in these lines have been restricted and with this restriction on the farm has been lost that old-time education that counted for so much. When girls learned to spin, and make soap, and pickled meats, when the poultry and butter was in their hands, they had something to do that trained the hand and brain and constituted the very best elements of education. We often forget how the human race has been educated. It has come to that measure of efficiency which it now possesses, not through the study of books and not through those studies that have resulted in books, but it has come to this through the medium of the hand in developing what we commonly call the arts of peace. That is, through the hand activities, directed by the brain, man has discovered and preserved the knowledge that he has, and which constitutes our science today.

But our people now are living under different conditions. For the boy and girl in the city there is almost nothing to do with the hands. We shut them in school for nine months in the year instead of three: and we put them to studying books. Men, some of them old and some of them young, when we go to them and tell them that in school there ought to be something for the boy to do with his hands, for the girl to do with her hands, not merely because this knowledge of the manuel arts may prove more useful to them in some active employment, but because it is necessary as a means of their education, that this hand activity be developed in the plastic years of childhood—they tell us they do not want any fads of that sort in the school. They want practical studies, like arithmetic, reading and writing.

I take it that the audience that has gathered here is not very much in sympathy with that view. You recognize the educational value of these things as we teachers do, and you also recognize the enormous practical importance, when boys are to become skilled mechanics, that in early life they gain that accuracy of space conception that comes through early acquaintance with the use of tools. And you will believe that the girls who are to become managers of the home should acquire in their school days an active interest in, and acquaintance with, as much as possible of the science and of the art that makes home beautiful, sanitary and homelike, in all the best meaning of that old term.

Now, I believe that most of us are ready to say, as Superintendent Cooley, of Chicago, said only a few days ago, in a report to his board, that the board should move at once towards a realization of the idea that at least one fourth of the time in the elementary and high schools should be given to manual training and mechanical drawing in the case of boys; to housework of various kinds, to the study of household needs, and to the acquisition of skill in them, on the part of girls.

Now, where shall the teachers who are to do this work be trained? We naturally would think that inasmuch as the normal school exists to train teachers for the public schools that it should take up this work. There is, however, a very unfortunate practical diffiulty that exists everywhere in the case of our State Normal schools. They must look to the legislature for the appropriation which maintains them. So numerous are the calls for public funds that a reasonable economy must be recognized. So we find as a consequence that it is not easy to secure the introduction into the normal schools of any new branch of study for which there is not a pressing public demand. As soon as the legislatures feel that the people want anything taught in the schools it is not difficult to secure the appropriation.

So it happens in regard to domestic science and manual training and other new studies that have found their places in special courses of study, that the state normal schools have not as a rule been the first to introduce these new studies. Take the case of the domestic arts, the household science, which we are discussing today. We know, that in Massachusetts Mrs. Augustus C. Hemenway established a domestic science school in Boston. At the same time she also established a school for the training of teachers in gymnastics. She did this to prepare the way until public sentiment was at that point where the state of Massachusetts should take over these schools, as it has since done, adopting them as a part of the state normal school system.

In the same way in our sister state to the north, Wisconsin, we find an excellent equipment for the teaching of domestic science in the normal school at Stevens Point, and also provision in other state normal schools. But this provision was made only after Senator Stout at Menominee had established the finest equipment of this kind in the west, and had taught the public what it would mean to have that sort of teaching in the normal schools.

The state normal school of Colorado was enabled to do this work early from the fact that it had an abundant permanent income, and was not dependent upon legislative appropriation.

There are certain advantages for the training of teachers of domestic science in the normal schools, in which teachers are trained for other species of school work, over the training of such teachers in the special schools where they do not come in contact directly with other species of school work. I have heard superintendents say that if teachers are trained in special schools, such as Pratt, Drexel, Armour and Lewis, when the teacher comes into the public school system she is likely to stand somewhat apart from the rest of the corps, and her branch is regarded by the parents, and even by the students, as a thing apart, and a sort of experiment, and not one of the real school studies.

Then old superintendents testify that teachers trained in the normal schools, no matter what they are to teach, manifest a keener interest in general educational problems; there is more interest in the teachers' institute, in the association meeting, and in the reading circle work. In the normal school the attention of the teacher is not directed so much to a particular subject as to teaching a child. The problem is to develop the child into a man rather than lodging in his head a certain mass of information that the teacher believes of value to him.

Now, wherever the teacher of domestic science has found a place various phases of domestic science are taught. The well equipped teacher of domestic science must know the whole subject from the ground up. She must not only know it as a woman in the management of her home needs to know it, but how it can be fitted to the growing capacity of the child. In other words, the different branches of the work must be adapted to the powers of the child, to the tastes and interests of the child. The child that is interested at the age of 7 or 8 in dressing her doll is a different child from the young woman graduating from the high school, then interested in the questions of marketing, of planning, furnishing and decorating the home.

In these courses of study to which I have referred, and which I have no doubt will be taught in all the normal schools of our lands within a few years, we consequently find a few lines of work covering the entire course of this subject as it must be taught in the elementary and high school. Here is the great subject of food: The selection of food; the grade of food; the general subject of the process of cooking, and all that is related to it, including the character and care of the kitchen utensils, becomes the science of the kitchen.

Then there is the general study of the fabrics to be used for clothing and decoration, the source of those fabrics, and the selection with reference to worth and service and cost; the principles of sewing, the different kinds of stitches, and the reasons why certain forms of stitch must needs be applied to the various kinds of seams or to unite particular fabrics of different kinds; and ultimately for the older girls in the high school, and so with the young ladies in the normal schools, the scientific drafting, fitting and making of garments.

And then there is another division of the subject that is often referred to as houshold economics, not included in the study of food and clothing. We mean such subjects as the planning of the home so that it shall be convenient, sanitary and beautiful; the subject of furnishings and decorations; the question of the sanitation, heating and ventilation of the dwelling; the use of the various cleansing materials in the laundry and elsewhere about the house; the question of emergencies, what to do in case of illness and persons subjected to various forms of accident that may prove fatal or injurious. Then the general subject of marketing, the relation of the home to the outside world, the question of household accounts; and many others included in the management of the home outside of the lines I have mentioned.

Furthermore, because the whole purpose of this movement for the introduction of the domestic arts in the public schools is to bring into the home what modern science can bring to make the home better, it is evident that what we call science must have a large place in the training of women for housekeeping. The girls in the high school now study chemistry, but it is a thing apart. It is something that has no vital and immediate connection with the life they lead outside; and, consequently, not long after the young lady graduates from the high school her chemistry has passed away. But her education along these lines can be made far more useful by giving her a knowledge of practical household chemistry; what cleansing materials can be used for; about the composition of foods; the making of a menu in order that it may meet the wants of the body; the changes that take place in foods through the application of heat and the various other cooking processes. All these are merely applied chemistry, and the study of chemistry in the high school would be vastly more interesting if given a practical turn than it ever becomes as continually taught in the present high school courses.

In the study of biology, we must all know something of the laws that govern life, both in the animal and vegetable world; to study properly those plants that are of use to man because they produce foods, condiments and fibres; those animals, whether wild or domesticated, because they produce foods or articles of clothing, or are useful in other ways.

The study of insects; the insects that infest the home; the insects that destroy our useful plants. This should be a part of the training of every housekeeper.

I might add to these in the same connection, the practical study of the vegetable garden, for I believe that the women of the future, as their grandmothers of the past, and still more those primitive women described in the previous address, will learn how much better it is to get nearer to the soil, nearer the soil too than in the potting of their plants in the autumn months when they are taken indoors.

Besides this study of chemistry and biology, there is the study of bacteria, the myriads that infest the dark or damp places in the home, and are so often destructive to fabrics and health.

Then we have the study of physics in relation to ventilating, lighting and heating. The study of physiology and hygiene, as related to all of those various lines of study. They will all be taught in the normal schools to the teachers of domestic science.

Then there is a sort of study that we must call professional; such as the principles of teaching as applied to domestic science; organization of domestic science work in the schools; the development of domestic science as a part of the public school course. They all have some connection with the management of the courses of domestic science in the public school systems of the State as they now exist. The history and literature and development of this subject as a school study is now apparently growing in popular interest in our country.

These are subjects upon which the teacher of domestic science needs to be informed, and well informed. There are still other lines. I question whether any woman can understand fully her place today as a homekeeper and homemaker, whether she can exactly free herself from the bonds of tradition which her mother and grandmother had before her, unless she has studied enough of industrial history to understand the industrial revolution that has taken the domestic industries out of the home and put them in the factory, and brought a multitude of other necessary changes in all our interests and modes of life. Industrial history needs to be a part of the training of the household science or manual training teacher.

There are certain phases of geography, such as the sources and preparation of food materials and textiles. They are all a part of the life of the well-equipped housekeeper.

Now, with regard to our Illinois normal school, I regret to say that if I told you of the domestic science that is taught in the Illinois normal school today, my story would be as short as that famous chapter on the natural history of Ireland, that famous chapter on "Snakes," in which Father Kelly said, "Blessed be St. Patrick, there are no snakes in Ireland." We leave out the "Blessed be St. Patrick," because we do want domestic science in the normal schools of Illinois, and I believe we are going to secure an appropriation amply large for building and equipping a manual training and domestic science school that will enable us to equip all our teachers with some knowledge of those arts, and some of our teachers with all of the knowledge necessary to accomplish something of value in these fields.

I want to say that the women of Illinois, and especially the president of this association and a number of its members, have made themselves felt at Springfield, because I was shown a large stack of letters by one legislator which he said he had received from the women in his district, all urging him to support this particular measure; and it is for this coöperation, in behalf of the teachers of Illinois, and especially in behalf of the normal schools of Illinois, that I wish to thank this association.

The President—You know our association is a part of the farmers' institute, because we are the wives and daughters of farmers, and we have learned that whenever we want anything in the formers' institute, we have no hesitancy in asking for it, because we know we shall get it, just as we know we shall get anything of our husbands—we shall get it by asking for it. And I am going to ask the gentlemen here this afternoon to do something for us. We would be very glad if every gentleman in this room would write two letters—that is not much to do—more than two letters, in fact—one to each of their representatives, and one to the senator from their district, asking them to use their influence in securing this appropriation. Now, I take it for granted that if you were not interested in making better homes, and having the girls that are going to be the future homemakers better trained for that work, you would not be here, and stay here through these two hours so patiently and quietly. So now we ask you as an association to help us do that to get an appropriation. And I want to ask the women that are here to do the same thing. It is those letters that go into the legislature that show those men down there what the people want. Those men are at the legislature to represent us, and they are going to do what they think we want them to do. Of course we have no votes to back up our letters, but I think it will have the same effect.

If there is one achievement of this Illinois Association of Domestic Science of which it is more proud than any other, it is securing at the State university the new household science department. It is one in which the girls can be taught this science. And in addition to securing that, we also secured a free scholarship for one young lady from every county. If there is anyone here who would like to send a daughter, or your friend's daughter, to that domestic science school next year, probably you will be able to do it through this association.

Miss Anna Barrows, Boston, Mass., Director Chatauqua School of Cookery and Chairman of Household Economics Committee Massachusetts State Federation, was next introduced by President Mrs. King.

THE EFFICIENT WOMAN.

To be efficient is to have energy and power to act and to be competent to produce results outside of one's self.

Such efficiency in any human being depends upon the ancestors, the environment, and the education.

The country life is an important factor in producing efficient men and women. There is everywhere today a demand for efficient women in the homes, the schools, the hospitals, and in all departments of life. Many women there are, possessing "the vision and the faculty divine, yet wanting the accomplishment" of any definite end. This may be due to lack of physical strength or to insufficient education to give power to produce results. Yet women have played an important part in bringing civilization on to its present plane. Dr. O. T. Mason, in his valuable book, "Woman's Share in Primative Culture," claims that woman is the inventor of all the peaceful arts of life. She has been the "food bringer, the weaver, the skin dresser, the potter, the beast of burden, the jack of all trades, the artist, the linguist, the founder of society, the patron of religion."

For a picture of the type of efficient women needed in this twentieth century we may well go back through the centuries to that drawn for us by the wise man of the Old Testament.

"The heart of her husband doth safely trust in her, so that he shall have no need of spoil.

"She will do him good and not evil all the days of her life."

John Ruskin puts the same thought in another way: "Wife means weaver. You must be either housewives or house moths, remember that. In the deep sense, you must either weave men's fortunes and embroider them, or feed upon them and bring them to decay."

And whether a woman has a husband or not this statement of Ruskin's is true of her relation to father and brothers.

Some one has said that it is "astonishing how many women are willing to take upon themselves the support of inefficient men," which may be due to the lack of enough efficient ones to go round. Many a woman has acted as a moral support to her husband or to the other men in her family circle when there was no need of her sustaining even herself physically.

Let us further follow the description in Proverbs and see how well it applies to modern conditions.

"She seeketh wool and flax and worketh willingly with her hands."

Women who have worked out the problems of the household with hands and head are always more efficient than those who depend upon the hands of others. Here is one of the weakest links in the chain of civilization—we are unwilling to work with our hands, and invent all sorts of excuses for relegating hard work to others. There are many of us who, like the old negro in Booker Washington's story, "have a call to preach" because "de cotton am so dry, an' de sun am so hot, an' de flesh am so weary."

"She is like the merchants' ships, she bringeth her food from afar." This is even truer today than in the long distant past when it was written.

The modern housekeeper reaches around the whole world, north, south, east, west, for the foods for a single meal served at the table. But there are dangers in being over zealous in this direction. The foods may be rendered unwholesome by their long journeying and we may tempt those who look to us for food to over-indulgence in the choice tidbits we have been at such pains to secure.

"She riseth also while it is yet night and giveth meat to her household, and a portion to her maidens."

The housekeeper of the twentieth century has helps not available in the days of Solomon, which have done much to shorten her hours of labor. Gas stoves, electricity and other time-saving appliances have made it unnecessary for some women to "rise while it is yet night," and more wonderful inventions will aid the housekeeper of the future.

There is one lesson here for the present time, however; too many of us are losing the habit of "forehandedness," and live litterally from hand to mouth instead of planning and preparing the food for our households in advance of the time of serving it. There is also a hint that the efficient woman of the past controlled the household service situation as the modern housekeeper does not; that she assigned the portion to her maidens instead of submitting to their dictation.

"She considereth a field and buyeth it; with the fruit of her hands she planteth a vineyard. She girdeth her loins with strength, and strengtheneth her arms."

Here is a suggestion that women of today do well to heed, and some of them are learning that a plot of ground well used will bring back health and strength, and more than provide a living to those who have spent their energies for years in the school room or office.

"She perceiveth that her merchandise is good; her candle goeth not out by night.

"She layeth her hands to the spindle, and her hands hold the distaff."

Evidently the truly efficient woman of the past did not submit tamely to the dictates of the fashion-makers, but she demanded reliable articles that would answer for the purpose for which she designed them—even her candles were the best of their kind and not sham. The woman of the present and future if she would perceive that her merchandise is good must adopt the principles of the consumer's league, must think of the mutual interests of producer and consumer, must not demand something for nothing and trading stamps as well. Perhaps if more women laid their hands to the distaff, were producers as well as consumers, the bargain counter, the trading stamps and similar evils would disappear.

"She stretcheth out her hand to the poor, yea, she reacheth forth her hands to the needy."

"And still beyond your household duties reaching,
  Stretch forth a helping hand;
So many stand in need of loving comfort
  All over this wide land.

"Perchance some soul you aid today,
  Tomorrow may with the angels sing;
Some one may go straight from your earthly table
  To breakfast with the King."

How are we to help the poor—the Indians, the negroes already our fellow citizens, the foreigners who throng to our land, to become efficient men and women, living simply and hygienically, unless we set them the example in our own homes?

"She is not afraid of the snow for her household; for all her household are clothed with scarlet.

"She maketh herself coverings of tapestry, her clothing is silk and purple."

The woman of ancient times evidently enjoyed good clothing as well as do her descendants, but the protecting quality of clothing appears to have been more important than its decorative possibilities. The efficient woman of today has learned not to impede her progress in muddy streets or mountain climbing with trailing skirts; nor does she ignore the importance of beautiful clothing when that is suitable.

"Her husband is known in the gates, when he sitteth among the elders of the land.

"She maketh fine linen, and selleth it; and delivereth girdles unto the merchant."

This seems to indicate that the wise man of the far distant past thought it reasonable that the woman who had mastered the business of home-making might be allowed an opportunity to use her energies also in occupations outside the home.

The modern economists who see dangers to social conditions in the idleness of so many married women whose husbands prefer to support them are only repeating the wisdom of Solomon.

"Strength and honor are her clothing, and she shall rejoice in time to come.

"She openeth her mouth with wisdom, and in her tongue is the law of kindness.

"She looketh well to the ways of her household and eateth not the bread of idleness."

The later years of life need not be idle ones and they give opportunity for leadership in many ways where experience is essential. The most efficient leaders often criticise least but advise with tactfulness and diplomacy.

"The efficient people," says Dean Briggs, "are those who know their business and do it promptly and patiently; who, when leisure comes have earned it, and know they have earned it; who, when one thing is done can turn their attention squarely and completely to the next thing and do that."

And the conclusion of the subject shows us that the efficient women of the past and present find their highest happiness in the appreciation and help they receive from members of their immediate household and other friends.

"Her children rise up and call her blessed, her husband also, and he praiseth her.

"Give her of the fruit or her hands, and let her own works praise her in the gates."

OVERFLOW MEETING, CASTLE HALL, 2:30 P. M., FEBRUARY 22.

At 2:30 p. m., Wednesday, Feb. 22, 1905, an overflow meeting, held in Castle Hall, was called to order by Mr. Edward Grimes, chairman, who said:

Now, gentlemen, please come to order. This is an overflow meeting, and was called for half past two, and the time has now passed, and we believe in beginning on time. The gentleman who is to address you at this overflow meeting, this class meeting of live stock, was expected here this morning. His name appears on the program for the morning session over at the opera house, but, through some misunderstanding, he was not here. He would have been here if he had known that he was to come on at that session. So that the committee has arranged to have the gentleman talk to the class here at this hour. Now I have the pleasure of introducing to you Professor Curtiss, dean and director of the Agricultural College of Ames, Iowa.

PROFESSOR CURTISS.

FEEDS AND FEEDING.

GENTLEMEN—I feel that I owe you an apology for not being able to be here this forenoon, and not keeping my place on the program. I take all the blame upon myself, however. And in looking into this audience, which, as I understand, is an overflow audience, this being an overflow meeting, I am reminded of a story I heard a few days since, in regard to the late Frederick Douglass. An Irishman who had lately arrived in this country heard Fred Douglass making a speech, and as he appeared to be a different sort of an individual from what he was accustomed to, he asked someone sitting next to him what kind of a man that was. He was told that was a mulatto. He asked, "What is that?" "Well, that means half negro and half caucasian." The Irishman said, "Well, Holy Moses! If half a negro can make a speech like that, what could a whole negro make!" If this is an overflow audience, I have a curiosity to know what the real thing is, and I think I will slip away from here after awhile, and go over and see the ladies. I am interested in what they are doing.

Nevertheless, I like an audience like this. It is apparent that you men are here for business; that you are studying intently the problems of the great work in which you are engaged. And in that connection, I think we have abundant reason for congratulation at the advancement of recent years. By the last census, we learn that the efficiency of human labor on the farms of the United States has been increased about 33 per cent in the last twenty years. That, it seems to me, indicates wonderful progress; a great advancement. We find, too, by that last census, that there are relatively fewer people engaged in agriculture, in comparison with other occupations, than there were twenty years ago. The number has fallen off something like 10 per cent, while the number engaged in manufacturing industries has increased in about the same ratio in that time. That does not mean that there is any decrease in agricultural production. On the contrary agricultural production has constantly and steadily increased. But the efficiency of human labor, the improved methods, and the greater intelligence that have been applied in this great productive industry, has made the individual man more of a factor than he has ever been before. And there is no place on the face of the globe where the individual man stands for as much in agricultural production as in the central west. The farmers of the central west produce more per capita, they have more to represent their labor, than the farmers of any other section of the world. All of these things indicate the improvement that has come about, and that must continue to take place, if we are to maintain the proud position of the agriculture of the central west.

Now, I believe I am to talk upon the subject of feeds and feeding this afternoon, and in entering into the discussion of that subject, I wish to say that I shall not attempt to cover the entire range of feed stuffs, or to give a general discussion on the subject of feed stuffs. But I wish to call your attention to what I regard as one of the most important features of this subject of feeding domestic animals; and that is comparatively a small part of it. At least, it is a part that we give minor consideration to as a rule in discussing the subject of feed stuffs. I wish to speak especially upon the hay and forage part of our feed stuffs, and the hay and forage ration as it enters into the production of live stock.

We have had and are having a great corn revival throughout Illinois and Iowa; throughout the entire corn belt. And it is an excellent thing. It certainly means that we are going to produce very much better results. We are going to get more from the corn lands of this great west. But we need to have, as well as a corn revival, a grass revival. We need to study the grass crop as well as the corn crop. The two great agricultural products of the central west are corn and grass, and the greater of these is grass. That is, the grass and the forage crops of our farms and our farming states, are of greater value, taken the one year with another, on an average, than any other single crop that we produce. As a rule, we give less consideration to the hay and grass lands—and especially is that true of our grazing lands—than to any other part of our farms. I believe they are the lands that are the most susceptible of improvement. And it is the crop, in which we can increase the returns with the least expenditure of additional labor, and at the least cost. In my remarks this afternoon, I wish to confine myself especially to this phase of the feeds and feeding problem.

We are confronted with new conditions in the agriculture of the central west today. We have seen these lands advance, within a decade or a little more, from $50.00 and $75.00, to $100.00 and $150.00 per acre; and it is my prediction that they have not yet reached the limit. At the same time, while these western lands have been advancing in value, we have experienced a decline of 25 to 50 per cent in the lands further east; the lands of the Ohio and Miami valleys, and eastward from that. There will sometimes be a corresponding decline in the lands of this section, and a corresponding advance in the lands of some other sections, if we do not give attention to the right methods of maintaining the productive capacity of our farming land.

Of course the live stock feature is the all-important feature in this problem of maintaining the soil fertility and the productive capacity of farm lands, but I am not going into that. I believe that as our lands advance in value, contrary to the common impression that we must have less hay land or less grass land, and more productive corn land, or more land devoted to the corn and cereal crops, that the reverse should be true; that as our lands advance in value, we should have a correspondingly greater part of the land in the the grass and forage crops. You have today, in the State of Illinois, about one-sixth, or 16 per cent of the entire farming area devoted to hay and forage. We have more than that in our State. We have about 20 per cent, or one-fifth of the entire area devoted to hay and forage. So you see it is a very large factor in our farming operations. These lands produce, in our state, about $100,000,000.00 worth of products per year. In your State you produce, I think, relatively, about the same amount. You produce about the same proportion to the area that you have in grass and forage. Your area is somewhat less. The grazing product alone, of our State, is equal to any other crop that we produce. It is practically equal to the corn crop of this, a year of an abundant crop and high prices. And in other years, when our corn crop is less, and when our prices are lower, it exceeds that, So, taken one year with another, there is no single crop produced in a state like Illinois or Iowa that exceeds in value the hay and forage crop, including grazing.

Now we have passed the time of cheap lands, consequently we have passed the time of cheap feeding products, of cheap feed stuffs on the farm, and apparently we have passed the time of cheap labor. All of these factors that enter into the production of live stock, into the production of meats and the meat products from the farm, have advanced in value materially. They have advanced, if anything, even more than the lands from which these products are produced, and it is not likely that they are going to become much cheaper. It is not likely that we shall ever have much, if any, 15-cent corn. It is not likely that we will ever have $10 bran again, or that we will have $15 or $18 oil meal, or that we will have $18 or $20 cotton seed meal, or any of these products at the old basis of prices. So the matter of compounding a ration, the matter of balancing a ration with our corn crop as the basis is a matter of supreme importance. These products are all more expensive, and it requires constantly a greater outlay to get together the feed stuffs that are essential to produce the best results in growing live stock. We all know, that valuable as the corn is, it is not a complete ration, and if we expect to produce the best results in growing animals and in dairy stock, and in developing horses and maintaining the breeding qualities of our animals, that we must have a variety of feed stuffs, and we must have the constituents that go to build up the bone and muscle and properly develop the animal in the highest form and highest state of excellence. These things are absolutely essential; never so much so as today, in view of the high priced land that we have; in view of the quicker returns that we must get from these animals, and the higher excellence that we must produce in the finished product. That point is generally conceded by all successful stock men. In the face of the fact that we have higher priced labor, higher priced feed products of all kinds, the problem presented is how we may cheapen the production of these animals, by the rations we use, or the methods we employ in growing and producing them on our farms and produce the finished product at comparatively a lower cost and without sacrificing any of the excellence.

I believe that the grass crop affords, today, the surest and most practical means of doing this. That is, I think if we would give to the improvement of our forage crops and our pasture lands the same attention that we have given to the improvement of our cultivated crops and our grain crops, that we would receive a larger increase, larger returns for less expenditure, than any other improvement that we may have.

I think, in the first place, that we will be able to extend the grazing season. It is sometimes said that when land becomes worth $100.00 an acre or more, that it is worth too much to maintain in grass. I believe that statement and that theory is entirely fallacious. You will find today, in the rich agricultural land of Great Britain, a larger area of grass, relatively, than you will find in Illinois or Iowa. You will find lands worth $300.00 or $400.00 an acre, more largely devoted to the growing of grass crops than they are in this country. And I believe, if we are to maintain our farms in the highest state of productive capacity, and conduct them with the highest profits, we will be obliged to devote a larger part of our farming lands to grass production, and relatively less to corn production. I believe that if we were today to reduce the cultivated lands devoted to the grain crops 25 per cent, and apply better methods, and devote that reduction of grain crops to grass production; that we might maintain our present output of grain, and at the same time have this increased grass land, that could be applied to the production of live stock, with greater profit than any other part of the farm. And I think it goes without saying, we all recognize that we could reduce the acreage of our cultivated grain crops ¼ per cent without decreasing the yield, if, at the same time, we would apply the better methods of more thorough cultivation and of rotation, and the improved methods of agriculture which are being introduced today.

Now, in view of the fact that the grain crops have all advanced in value, in view of the fact that everything a farmer buys to balance his corn crop is high-priced, and will undoubtedly continue high in price, I believe that we have, right on our farms and in the products of our farms, the means of balancing that ration, with greater economy and with greater profit, and with greater advantage to the maintenance of the fertility of the farm, than through the purchase of any of the by-products from the factories or the mills. These by-products must continue to be high. And while of course we do not expect to quit producing them, because there is a certain output from our factories and our mills that must always be consumed on the farm, and they ought to be consumed here rather than go abroad, yet there is a limit to the price we can pay for them and utilize them with profit. And instead of paying out a large amount of money for these products at high prices, we might better produce on the farm the feeding stuffs containing the nutrients and the elements of growth and muscle and bone-making that we need in our animals. The safest, the surest and the best means of producing that will be through the grass crops rather than in the grain crops.

Now I think we could, in the first place, extend the grazing season from two to three months in the year, on nearly every farm throughout this State, and throughout our state, and other states similarly situated. In fact, we do not get good grazing more than five or six months in the year; seldom more than five months. And wherever we can grow blue grass, we can extend the grazing period to eight or nine months without serious difficulty. Particularly is that true with regard to the production of horses and of beef cattle. It can not be so readily done with dairy cattle, for the reason that we can not expose them so much, and have them out so many months in the year. But by maintaining our lands in good condition, and providing for a good growth of grass throughout the summer months, and carrying a surplus into the autumn and over the winter, we can graze up till the first of January in nearly all parts of this State. From this latitude south there will be no difficulty. And then, by maintaining a surplus of grass on the pastures over the winter, we can turn stock out by the first of April, instead of the first of May. So we can add two months to the grazing period at the end of the season, and one month at the beginning of the season, by holding in reserve on our grass lands a surplus of feed, which can be drawn upon at that time.

In order to do this, however, it will be necessary to give attention to the grass lands, in the way of building them up; in the way of cultivating them. If we expect to grow a crop of grass, we must expect to feed that crop, the same as we feed our live stock. And we must give the same attention to the cultivation and the maintenance of the grass lands in the best state of fertiity that we give to other parts of the farm. Three-fourths of our grass lands are relatively neglected lands. The pasture lands, as a rule, are the poorest and most inferior parts of the farm. It is not always the case, but as a rule, the the pasture receives no consideration, until all other parts of the farm have been brought under improved methods. And if we were to give it the annual attention in the way of top dressing, in the way of harrowing and distributing fertilizer, in the way of renewing the grass seed, and in the way of drainage, keeping the soil sweet and light and in the best possible condition, I believe that we could practically double the output from our pasture lands.

One of the first essentials is to see that we have a good stand of grass. So many of our grass lands are simply set aside to grass, and they are grazed closely from the beginning to the end of the season. The soil bakes, and becomes what we call hide-bound, at times. The grass dies. And then if it is exposed when it is bare during the winter, and during the mid summer's severe drouth, it drys out and kills out, and very soon we will have not more than half or three quarters of a stand of grass on many of our grazing lands. And whenever the condition occurs, nature provides for a covering, and the weeds come in there, and they take possession of the soil, just as soon as there is an opportunity. Just as soon as there is a reduced condition or weakened vitality of the grass crop, the weeds will come on and take possession. So that over a large part of our grazing lands, we have not a stand of grass at all, in many cases not to exceed one-half a stand.

The first thing should be to secure a stand, after providing drainage. Of course that should be the beginning of all agricultnral operations. We should have our grass land drained, as well as our agricultural land, and if we do not, we cannot expect returns. Or course, we may get an inferior, coarse, rough sort of grass, but it will not be the grass and it will not be the production that we must have from our valuable land today. No man can afford to own valuable land, today, that is not drained. That should be the beginning. Then we ought to go through our grass land, and make sure of getting a stand, the very first thing we do. I do not mean that we ought to put a plow in and plow them up, regardless of the conditions, or what we want to use them for. I want to say empatically, that the best grass land of the world, in all farming countries, is land that has been devoted to grass for centuries. And that will be so in this State. Of course it may be desirable, and will be desirable, to rotate a good part of the farm. But if certain portions of the farm can be put into grass and left there permanently, and then the weeds come in. If our land is lacking a stand in grass, it will not be necessary to put a plow in and plow it up and re-seed, to start over again. We can put the disk and harrow in there, and give the surface of our pasture land a thorough cutting up; so complete a cutting up, that it will look, perhaps, as though but little grass remained. But put on in connection with that, clover and timothy seed, and alsike, and we can at once get a stand of grass, without in any way disturbing the sod which has been there so long, and which is of such great value in getting the land up to its highest state of production. It will surprise you to see how much this will improve the grass land.

We have recently made some experiments on the college farm at Ames, with bluegrass pasture land that was not by any means in a low condition. It had been pastured, but kept up in a good state of fertility, but by going on in the spring, just as soon as the frost was out of the ground, and putting a disk on and cutting it up, and then sowing the grass seed at the rate of two or three pounds per acre, dependent upon the varieties—sometimes as much as five pounds per acre—and following that with a harrow, and then not pasturing too heavily for a time, we have been able to add as much as 100 per cent to the productive capacity of the soil in the first season, and that advantage will accrue for several seasons to follow. It is very easy to add 50 per cent to the grass crop in a single year, by this method. Instead of having grass land growing weeds, we can have the entire area growing grass. There is never any trouble about weeds in the pastures, if you first have the soil in good condition, and have grass enough to make a good stand. We see weedy pastures all over this country, on the best farms as well as the poorest farms; and in nine cases out of ten, the sole trouble is that the methods of managing this grass land have been wrong, and the weeds stand is a protest against that farmer's methods. The weeds would not be there if the methods had been right, and if there had been an opportumity for the grass to take possession of the soil. If you give our grasses possession of the rich farming land of central Illinois, or any part of the State, and maintain the soil in the right condition, there will be no trouble in keeping down the weeds.

These are some of the first things that need to be observed in the growing of grass. Then, when we get our lands in that condition, we need to keep them there. It is like the old English gardener said to an American lady, about making a lawn. In traveling in England, she was very much taken with the richness and the velvety, luxuriant growth of the English lawns, and she thought she would get a receipe for making that kind of a lawn, and have some in her own dooryard; so she asked him if he would kindly tell her how he made a lawn, and got it in such nice condition. He said, "madam, it is very simple. I prepares the seed bed perfectly, and I sows the grass seed, and then I waters it and mows it, and waters it and mows it, for 400 years, and then you have a lawn."

Now, that is the way to make a pasture. We must get the soil right; get the grass seed in there; and keep it in there; and then feed the grass crop the same as the corn crop. We know we cannot grow corn unless we get the soil up and keep it up in a high state of fertility. And the same is true of the grass crop. If we give the same attention to the improvement of our grass lands, we will get double the returns for the outlay and labor and expense that we would get in improving our tillable lands.

Then the great advantage, the chief factor in this feature of our agriculture, after all, is that, in addition to producing a cheaper ration for the growing of live stock, in addition to producing on our own farms the feed that we need to balance the corn crop, we will be bringing about a condition of our farms that will, at the same time, increase the yield from our cultivated lands, because we can limit the area of our cultivated lands. We can increase the area of our grass lands. We can have a better system of rotation, and we can have our cultivated lands maintained in such a condition that they will yield larger profits, and the improvement of our grass lands will not only give us immediately beneficial returns in the maintenance of our stock, but it will give us greater profit in the returns from our cultivated crops as well.

Now, with reference to the ration for live stock. There is not any better ration than grass. There is not any ration that we produce on the farm, with the exception of milk, that is as good for the growth and the development and fattening and feeding of all kinds of farm animals, as grass. And especially is this true if we grow grass on good soil. There is a difference in grass. The grass that is grown on a good farm, and on good soil, is worth more than grass grown on a weak soil. You will find that true wherever you go. And there is not any single ration, with the exception of milk—and milk and grass are both nature's rations—no single ration that comes as near being adapted to all the needs of the domestic animal as the grass crop. And it is the cheapest crop that we have. There is a smaller element of human labor that enters into it than into any other crop that we produce on the farm. By increasing the area of grass land on our farms, we can not only improve the ration of the domestic animals that we are producing, but we can reduce the labor bill materially on the farm; and we can reduce, through that means, the expense of producing the animals, and at the same time we can produce stock that will be more profitable. The animals we have on the farm will be worth more money. They will be better breeding animals. They will have a higher degree of fecundity. There will be a larger percentage of breeding animals in the herds and flocks if every ration consists more largely of grass.

During the past two or three years cattle feeders have complained bitterly about the unfavorable conditions for cattle feeding. There has been relatively little profit in it. And I think you will find, wherever you go, that the men who have made the least money in feeding steers during the past two years, have made one of two mistakes. They have either paid too much for their cattle to begin with, they have paid too high a price for the raw materials that have gone into the finished product, or they have fed them too long on high priced corn. If corn is only worth 15 to 25 cents a bushel, then we may lengthen the grain feeding period without danger of consuming all the profits in the feed bill before we finish. But if we have high priced feed products of all kinds—high priced corn and high priced by-products, and high priced labor—and we carry those cattle on, as we are obliged to carry many of them, for six, eight, nine or ten months, there will be such an enormous bill accumulated that the returns are not likely to be sufficient to cover the expenses. And that is particularly true unless we get very high prices for beef—higher prices than we have any reason to expect. So that this affords, I think, one of the surest and one of the safest means of economy in the production of live stock; and not only economy, but greater efficiency and greater utility, and consequently greater profits.

Now, I imagine there are a good many men who may think that it is necessary to feed cattle as long as we do, six or eight or ten months, in many instances in order to have them fat enough; and sometimes it is necessary with the kind of cattle we put into our feed lots. They can not be finished properly in such a state of excellence as to command the top price or nearly to the top price, without a long feeding period. The trouble there may be traced to the grass lands of the farm on which these cattle have been maintained. If we have good rich pastures, and a good crop of grass there at all times, we can not only extend the grazing period at least three months in the year, which will be equivalent to an increase of 50 per cent or more, but we can produce relatively more beef on each individual animal that goes to market; so that we have a gain there again. And we can raise feeding steers that can be finished for the market in such condition that when they go into the feed lots, they can go in for a period of ninety or 100 days, and be finished in as good condition as if they had been fed twice as long when brought out of scanty pastures. So the advantages are very great in favor of utilizing the grass, the hay and forage crops to a larger extent, in connection with live stock growing and live stock feeding on our farms. It enters into every operation, with remarkable results.

Then, in addition to the matter of grazing, and the advantages that will accrue from feeding and building up and increasing the returns from our grazing lands, we can also profit to a like degree from the growing of the nitrogenous forage plants. The clover and the alfalfa will, of course, be the chief plants in that connection, and they will be the best balancing rations that we can get, economy and expense and everything considered. I believe that we will come to grow a good deal of alfalfa in states like Illinois and all the Mississippi valley states. Of course it will not come about rapidly. The clover crops do well here, and we know how to grow them, and it is easier to get a stand of them than it is of the alfalfa. The alfalfa sometimes disappoints us the same as the clover does. It will sometimes winterkill, and we are not so likely to take up with it as we would be if we were in a semi-arid region where we could not grow a crop of clover. If we were forced to it, as they are further west, you would see alfalfa growing all over this State. And as our lands become more valuable, and it is necessary to get higher returns from them, I believe we will increase the alfalfa crop of these central agricultural states to a very large degree.

But whether we do that or not, we have the clover crop, which can enter into our rations, and into our rotations, with marked benefit. And we need to produce more of it for that reason. Part of the alfalfa crop that is now grown in some of our western states is being run through a feed cutter, and cut up fine into a chaff, and shipped out all over this country, and sold at $20.00 and sometimes $22.00 per ton. It is an exceedingly valuable product. I do not know whether it is worth that or not. I doubt if a farmer can afford to pay that and feed very much of it. He may be able to do so under certain conditions, but it is a high priced product, and we ought not to be paying out good money for a product which we can grow at home, and produce more economically on the farm, and grow with greater advantage to our system of agriculture.

So by increasing these products, we have the means of balancing our rations. We have the means of profitable rotation, which will improve the farming land. And we have the means of shortening the grain feeding period. And if we grow them on the grass lands we have the means of reducing the bill for labor on our farms, because in the grazing lands, the animal does its own harvesting. We are not paying out money for cutting, gathering, harvesting, storing and feeding out again in the winter.

A good many people imagine that you can not pasture nine months in the year. They say that you can not keep stock out in the pasture that long; that when the frost comes, the grass is killed. If you have grass enough—and our blue grass must be the mainstay for the late fall and early spring pasture—if you have enough of it, there will be no trouble about getting good returns, unless it is under very much deeper snow than ordinarily occurs. And I saw a velvety mass of blue grass yesterday, that the suns had just melted the snowbanks from, and that blue grass was green. You could look down there into it, and see a tempting, wholesome, well-balanced ration. And when our snows go off, within thirty days, stock can be turned out on grass lands where a good surplus has been held in reserve, and they will do better, beginning the first of April, than they will beginning the first of May, if they start on a bare pasture, and have nothing but the soft, washy grasses that come in the spring. We have tested that for several years in succession on the college farm. We have compared turning animals out on to a good surplus growth that has been carried over from the previous season the first of of April, and turning them out the first of May on to pasture where there has been no surplus carried over. And we always find that they will do better, beginning the first of April on the grass land that has been maintained as I speak of, than a month later where they have to depend on the new season's growth. So we can very easily add a month to the grazing season there, and also improve the returns from the beginning.

Then another feature in which we can utilize our lands for grazing purposes to a large extent is this: All over our farming lands, you will find fields of stubble that grow up to weeds after the harvest is taken off. And those fields grow nothing but weeds until they are plowed under. They develop seeds, and they are there to develop weeds for the next season. We might just as well get something from that land as to allow it to go to waste in that condition. It will not cost anything to speak of, and we can get good returns from it.

For a number of years past we have made it a practice to sow about two pounds of rape seed and three pounds of clover seed to the acre with our small grain crops, at the time we are seeding the ground, sometimes three pounds of rape and five pounds of clover. The cost of the rape seed is comparatively nothing, and the clover seed will not be very expensive at that rate. In seasons of ordinary rainfall, 30 to 45 days after the harvest is taken off, you will have a good, rich, luxuriant growth of rape and clover there. Sometimes it will surprise you. It will be standing up knee-high inside of 60 days, and you can get an enormous amount of feed from that crop and you won't have any weeds growing on that stubble field, either, if you get your rape and clover seed well distributed. You will have a luxuriant growth of vegetation there that is of very great feeding value during the latter part of the season.

A farmer living in our State had 60 acres treated in that way. The first season he had a heavy crop of grass; it was a season of more than usual rainfall, and the rape had already started up before the small grain was cut. In fact, it got up into the bottom of the bundles a little bit when it was cut. He was a Scotchman, and he did not like that. He had not been accustomed to having anything interfere with his grain harvest, and he told his men that was Curtis's method of intensive farming, and if the Lord forgave him that time, he would never do it again. Well, he got his grain crop off, and the clover and the rape came on. He went to Omaha and bought 900 lambs and put them into that field, and grazed them a little over sixty days and shipped them to Chicago. He did not feed them a pound of grain, and when he got the returns and deducted all of his expenses, he had a net profit of just $600.00 from that bunch of lambs. In other words, he had just $10.00 an acre net profit from a stubble field which ordinarily goes to waste all over our state, and all over your State. Not only that, but he has repeated that operation every year since. Last year he had 1,500 lambs in there. I am not sure that he made the same degree of profit; he may not have had relatively the same returns but he did have a good margin of profit, and has made from $5.00 to $10.00 an acre each year from his stubble lands, which formerly he has had nothing from.

Now, this is not only of advantage in the way of the profits that you will get from that crop alone. It is of advantage in keeping the weeds down, in keeping the soil in a better condition. When you plow the field up in the fall you have the soil in better condition for the next crop, and you will increase the next crop, as well as your profits from the immediate returns.

These things are merely means by which, if we give attention to the grazing feature of our farms, and to some little things that do not cost much, but that render relatively larger returns than some of the greater things that cost more, we will get better returns from our entire acreage. We will make larger profits, and we will be improving our farms in general productive capacity at the same time. This will be of material advantage, I believe, in maintaining live stock on the farm in better condition. I spoke of the increased degree of fecundity. There is a good deal of complaint, all over the corn belt, about the result of excessive feeding of corn. And our animals do suffer. In the first place, we suffer in not getting the growth and the bone. Then we suffer in another way, in the animals lacking fecundity. We do not get the same number of calves from a herd of cows. We do not get the same number of pigs in a litter. Colonel Harris said to me the other day that his observation was that the average breeder was not getting more than 50 per cent of calves from his cows in the herd. In other words, the breeder is maintaining two cows to produce one calf. This refers to the pure bred herds.

If we will utilize the grass crop to a larger extent, we will have a ration that will maintain our animals in a healthful condition; that will increase their fecundity, and make them more profitable breeders, in addition to a ration which, as I have explained, will enable us to produce beef at less expense. You can produce beef on grass at a cost of 3 or 4 cents a pound, even on land that is worth a $100.00 an acre, if the right kind of steers are used, at the right age. But you cannot put those steers in your feed lot and make beef on corn, on less than 8 to 10 cents a pound, at the same age. Manifestly it is very clear that we need to extend the cheap feeding operation just as much as possible, and shorten the expensive feeding operation, and the way to do that is through increasing our grazing lands, improving our grazing lands, and increasing that portion of our feeding period in which the beef is made more largely on grass, and therefore diminishing that part of the feeding period in which the beef is made on expensive products of the farm. And corn has come to be an expensive feeding product. Even if we do not raise quite as many acres of corn, we can still make more profit by this method. And I feel that from this time forward, there needs to be not only a corn revival all over this country, but there needs to be a grass revival, because the conditions confronting us in agriculture today are going to force us, not only to get higher returns from our land, but to get higher returns at less expense. It does not matter so much if we get higher returns, and at the same time increase the cost, so that there is no margin of profit left. But if we can get higher returns without increasing the cost, then we increase the margin of profit. (Applause.)

Mr. Baker—Hasn't the tendency and the teaching all the time lately been to do away with the grass crop and increase the other crops?

Professor Curtis—There has been too much of that tendency; and too much of that teaching, I think.

Mr. Baker—For instance, a man was in one of my pastures a while ago and he says, "Baker, you are foolish to keep a pasture like this." He says, "if you take one quarter of this and plow it up and put it in corn and put it in the silo it will maintain more stock than this entire pasture." He was a thoroughly practical man but I did not do it because I like to see the cattle in the pasture. They look happy.

Professor Curtis—I think you ought to do just the opposite. I think you ought to take a quarter of your cultivated land and put it into grass and then put the same attention into the improving of your grass land as you have been putting into the improving of your corn land.

A Delegate—Is silage good food?

Professor Curtis—Yes, it is good food. It is good food and we are going to come to a greater use of the silo.

A Delegate—Why not preach it, then?

Professor Curtis—It is all right but grass is cheaper.

A Delegate—Is silage good for horses?

Professor Curtis—I don't think it is. I don't believe silage will be found a very satisfactory feed for horses nor sheep, although it has been used somewhat for sheep. But its main reliance will be for cattle.

A Delegate—What is your idea, and what is your ratio of acres per cow or cows per acre, for your pasture or grazing land?

Professor Curtis—Well, I don't think there is any inflexible ratio. It will depend upon the season and the condition of your soil. We have grass lands that are pasturing fully one animal per acre for the nine months. But of course those are exceptional and they are grass lands that we give a top dressing of manure once every two years. And then, whether we disk them up to put in grass seed or not—ordinarily we do not those, because the grass is already there and we could not get any more in—but we go over them with a harrow and sometimes we go over them with a disk and cut them up and then harrow them and distribute all the manure that is dropped there. And then we have given them a dressing of liquid manure from our cisterns at the cattle barns occasionally. When you treat good grass lands that way you can pasture one animal per acre, nine months in the year. But of course it will take very good soil to begin with and then it will have to be top dressed and harrowed once every two years or better every year,

A Delegate—Speaking from the dairyman's standpoint, we find here, especially in northern Illinois, that we turn out to pasture about the 15th of May or the 20th. The pasture then is good till about the 15th of July, take it on the average. Through the latter part of July and August it is apt to be pretty dry; needs to be supplemented oftentimes with peas and oats. So it takes out, say a month there. Then September and October is apt to be very good pasturage, perhaps till the 15th of November for dairy cattle. So I have made a close estimate and counted up five months for the dairy cow in northern Illinois. I have been one of those that has been thinking that the silo and alfalfa was going to take the place of the pasture. We can grow fifteen tons, I figure, of silage per acre. Gurler is doing better than that. That means that you can support three cows on an acre, feeding forty pounds of silage a day for twelve months. If you can grow alfalfa at the rate of five tons per acre, and we have grown it at the experiment station at the rate of eight, wouldn't it be cheaper for the dairyman to have alfalfa in the silo than to pasture?

Professor Curtis—It might and it might not. I think the dairyman needs to use the silo and the alfalfa because there is a time that you speak of, in midsummer, from July on till August or Sept. 1, when the pastures become dry, and there is the fly season when the cows that are in milk had better be in a darkened barn during the day and get some silage and alfalfa and be in the pasture at night than to be out fighting flies in the daytime. At the same time, in addition to using your silo, I think you can also improve your pastures and extend the grazing season and improve it to such an extent that the grass, when you have it available, will be cheaper than your silo. Of course you utilize the entire produce from an acre of corn; I know that; and you get higher returns than you get from any other crop we grow. But when you consider the labor element involved and all that, I think that the grass, to the extent that we can use it for the dairy herd, is a cheaper product even than silage.

At the same time, I realize that this method I have referred to for improving the pasture lands and extending the grazing season will not apply, as fully, as I stated, to the dairy cow as it will to these other animals. She cannot be left in the pasture during November and December. She must be in the barn; while the steer can go out and eat in the pasture.

A Delegate—Does not that system that you advocate depend upon the price of land and the price of labor? Supposing our land is worth $175.00 an acre, and we can hire help at $20.00 per month and board and washing. Cannot we then practice a different system of feeding than when our land is $100.00 an acre, and help is worth $30.00 to $35.00 a month?

Professor Curtis—Yes, that is true. But I don't know whether we are going to have any cheap labor or not. It has been getting higher.

A Delegate—In regard to this rape and clover mixture in the stubble, I am interested in that. What time of the year would you plow this land, provided you wanted to put it into corn the next season? Would you plow it in the fall, and what time, or in the spring?

Professor Curtis—We have been grazing ours till about the middle of October or the first of November, and then plowing it after we are through grazing it. The sheep will graze it right down to the ground, and there will not be a thing left there, and we want to plow it immediately.

A Delegate—Now, the amount again, please, and when you come to Will county next fall, you will find sixty acres anyhow, except we were going to leave out the rape; but I will put it in.

Professor Curtis—Well, put in two or three pounds of rape seed, and three to five pounds of clover seed.

A Delegate—How is that for a general pasture for cattle and horses?

Professor Curtis—It will not be a very satisfactory pasture for cattle and horses, unless you have relatively more clover and less rape. And yet you can get very good returns, too, in pasturing cattle and horses on a crop of that kind. We have utilized a field of ours, during the past year, for cattle and horses and sheep, all at the same time. It was adjoining one of our pastures, and we simply opened the gate and all kinds of stock pastured there. The sheep ate most of the rape. The horses and the cattle will take the clover first.

A Delegate—Sow the clover and rape with the oats?

Professor Curtis—With the oats, or barley, or wheat, or whatever you are sowing in the way of small grain.

A Delegate—You would not include milk cows, in the stock you would pasture on that?

Professor Curtis—No, I would not put the milk cows on the rape. If I were going to use it for dairy cows, I would not put in anything but clover.

A Delegate—I would like to ask a word about brome grass.

Professor Curtis—We regard brome grass as one of the most satisfactory pasture grasses that we have used. I do not think it is a satisfactory meadow grass with us. It gives its best crop the first and second years. After that, it begins to decline. It gets tight and rolls at the bottom, and shoots up slender, sparse stems, and the yield will be light. But put into a mixture of pasture grasses, we find it to be excellent. It is early, and comes on and makes a vigorous growth. It stands the midsummer drought decidedly better than any other grass we have, and it can be grazed throughout the entire season. We find it to be an excellent grass to put into a mixture.

A Delegate—You would advise, then, to sow that on old blue grass pasture, after you disked it?

Professor Curtis—I don't think you can get it in that way. The clover will take better there. If the old pasture were quite badly run out, you might be able to introduce the brome grass. But if there is a fairly good stand of blue grass, you will have difficulty in introducing the brome grass by that method.

A Delegate—No danger of running out the blue grass?

Professor Curtis—No; but it holds its own much better with the clover. A few years ago, we straightened up a fence where there was an irregular line, and threw four or five acres over into the pasture field that had previously been in the cultivated field. And in seeding that new piece we put in brome grass. And we found that the cattle would stay on that piece of brome grass, and keep it eaten closer than any other part of the pasture.

A Delegate—Do you advocate the inoculation of the soil for growing alfalfa?

Professor Curtis—Sometimes we have inoculated, and sometimes we have not. I want to say this in regard to that. I think there are a great many conditions under which inoculation of soil will give good results, and in which it will be profitable. And I want to say also with emphasis, that one reason why we have not succeeded in growing alfalfa to a larger degree, is that we have not put it on good enough soil. If you take the best piece of soil you have got on your farm, and give it a top dressing or a good rich manuring the season before you are going to seed it to alfalfa, the chances are you will succeed. But if you try the alfalfa on a poor, run-down soil you will fail with it, unless you inoculate. But if you have a strong piece of soil under excellent cultivation, you will get as good results without inoculation as with it.

A Delegate—Have you ever had any experience with English blue grass at your station?

Professor Curtis—Yes, sir; but we rely on the Kentucky blue grass, and I think it is more satisfactory. I think it will stand our conditions better than any other blue grass we have.

A Delegate—We have been practicing raising this rape for the last seven years without the clover. The first year we tried it, we had the clover, and we found the rape grew faster than the clover, and smothered the clover out. Mr. Glover speaks about excluding the cow. On what ground?

Professor Curtis—Because it impairs the quality of the butter.

A Delegate—We find we have no trouble before a hard freeze. We have sheep now in the pastures that are pawing down through the snow after the rape. We find it taints the butter after a hard freeze.

Professor Curtis—Mr. Glover, have you been able to make high grade butter from cows fed on rape?

Mr. Glover—Several experiment stations have conducted experiments to determine the quality of butter made from cows grazing on rape, and in every instance the judge detected the rape flavor. But I think if the cows were taken up an hour or two hours before they were milked, that that difficulty might be overcome. It is being tried with wild garlic; but so far they have not been able to do so.

Professor Curtis—Let me say in regard to clover, where you have the difficulty of the rape crowding out the clover, you sow a little too much rape. Reduce the percentage of rape, and increase the clover a little. Don't put in so much rape that it will completely take possession. Because it will exclude everything else if you sow it too heavily.

A Delegate—What benefit do you derive—that is, in proportion? We sow about two and one-half pounds of rape, and we find it a very profitable thing without the clover. The cost of the rape seed is merely nothing. The cost of the clover seed is greater. What profit do you derive by adding the clover?

Professor Curtis—Your advantage will come in this: The clover is a better feeding product than the rape. It contains more nutriment. It is a richer plant. And the two together will make you very much better grazing than the rape alone. And if you grow the two together for your hogs, it makes an excellent feed. We turned, this last year, 150 pigs, after weaning them, into one of those fields, and it was marvelous how well they did, on a very small amount of grain. And, then, you introduce the clover in your soil, and it enters into your rotation, and puts your soil in better condition. You maintain the fertility better.

A Delegate—Just a little statement: I have raised rape in an oat field for several years, on the advice of a graduate of Urbana, with good results every time. The first time I tried it, I didn't want to go in too heavily. I sowed about ten acres in the spring with the oats. As soon as I threshed, I opened the gate, so as to give the stock the run of a hundred acres. They had the oats that would naturally fall from the cutting of the oats to eat, a timothy field in one part, a blue grass pasture, and a clover field. My steers would nose through the field, and when they would come to the rape, they would eat that down. I have sold those steers the first of November 4 cents a pound off grass. The man is in the audience here that weighed them. He knows what they weighed. He knows what condition they were in. The man fed those cattle till the first of March, and sold them in Chicago at $4.15 a hundred. I considered that the rape was just as good feed as the clover, because they ate the rape right down to the ground. There were hardly any stubs left. Two years ago, I turned forty-one head of cattle that I was preparing for the feed lot into twenty acres of rape after threshing, and they could hardly feaze it. It seemed to grow up, in spite of everything they could do, as fast as they could eat it down. I plowed fifteen acres of that rape in the fall. Five acres of it was so good that I thought I would leave it and try my horses on it. I tried it with good success. This spring I plowed that five acres, and put it all to corn, and I could notice a difference in the corn crop, to the furrow, where it was plowed last fall and where it was plowed this spring. Where it was plowed this spring was the best corn. I cannot explain it in any other way than that the roots of the rape went so deep that it loosened up the subsoil, and when I plowed it this spring, a great many places the rape roots would pull out of the bottom of the furrow, the same as clover will, for a depth of eight to ten inches below the bottom of the furrow. And all through the season, that ground worked better than the ground that was fall plowed.

Professor Curtis—I want to say this in regard to rape. While it has excellent advantages and is a very profitable crop, and we can grow it to good advantage; it is an exhaustive crop. If you take a field, unless it is a very rich soil, in which you have grown a crop of rape the year previous the chances are that it will show its effect in the crop the succeeding year. However, by mixing the rape and the clover, the clover comes in to improve and build up the soil. Some men have not had as satisfactory results in grazing cattle as you have had. Sometimes they do not take to it at first and are not inclined to do as well, But generally where you have a mixture of a variety of forage crops they will come to the rape eventually and they will get very fond of it. And with reference to that man, now, that fed your cattle, probably that man feels that he might better have had more grazing land and less corn land. He did not get very much for his corn.

A Delegate—Will rape bloat cattle?

Professor Curtis—I think so, if they eat too much of it. It will bloat sheep and it probably would bloat cattle.

A Delegate—As regards orchard grass do you ever use that in your mixture for the pasture?

Professor Curtis— Yes, we like that. But I think the brome grass serves about the same purpose, and has some advantages over the orchard grass.

A Delegate—What do you balance your ration with, during the five months, for your stock that you are holding over through the winter?

Professor Curtis—I think the cheapest thing we can have to balance that ration will be alfalfa hay, or clover hay.

A Delegate—Would alfalfa hay and corn stalks, with the corn in it, be a balanced ration?

Professor Curtis—Yes, a very well balanced ration. Not what you would need for your young things on the farm, but for your older stock it would furnish a very good ration indeed.

A Delegate—What would you add for growing stuff?

Professor Curtis—For growing stuff you should have, in addition to that, some oats or bran, or some of the various by-products that could be used. But you would not need to use very much of that for your ordinary stock. Your dairy cow ought to have some more

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Professor Curtis—For growing stuff you should have, in addition to that, some oats or bran, or some of the various by-products that could be used. But you would not need to use very much of that for your ordinary stock. Your dairy cow ought to have some more nitrogenous feed, and also your younger and growing animals. But for your mature stock, or your steers that have been grown and are going to be turned off on the following season, a ration of that kind would carry them over in excellent shape.

A Delegate—If you were going to seed down timothy and clover in oats, and use it for pasture the next year, and wanted to put in brome grass, how much would you use, and how would you work it into the soil?

Professor Curtis—The brome grass is rather expensive, and it is not easy to handle in connection with other grasses. It is coarse and light, and you can not very well sow it at the same time. The better way is to put it on separately. Sow it either by hand or with the seeder, in addition to the other grasses, and eight to ten pounds to the acre. You see it takes forty-two pounds of it, I think, to make a bushel. It is coarse and bulky, and it is rather high priced. But it is an excellent grass. And when you are seeding down a piece of land for a permanent pasture, you can well afford to incur the extra expense. And I would say the best way to put it on would be to get your soil seeded, and your other grasses in, and then put it over the surface the last time, and give it a light harrowing.

A Delegate—Can you, from your experience, bear out the statement that a ton of alfalfa is equal to a ton of bran for feeding matter?

Professor Curtis—We are at work on that problem now, and we do not know yet. Men have been writing to us about that question. A man wrote the other day that he could buy bran at $20.00 a ton, and alfalfa meal at $22.00 a ton, asking which to buy; and I am free to say, I don't know yet.

Mr. King—What do I understand you would add to clover to benefit your stock?

Professor Curtis—This gentleman asked over here what would be added to a ration consisting of clover and corn fodder with the corn in.

Mr. King—I was only asking about clover.

Professor Curtis—Well, with clover alone, of course your grain element would be lacking. Then you would want corn, and a mixture of oats and bran, or something of that character, to give more protein than clover alone.

A Delegate—For your growing stock, would you add corn?

Professor Curtis—Not very much. Of course I would not leave corn out, because it is our cheapest and most abundant feed, and we can use it with profit, but I would not rely on it entirely.

A Delegate—Would corn and a little bran and shredded corn fodder make a pretty good ration for young stock?

Professor Curtis—Yes, sir; but it will make a good deal better if, in addition to the shredded corn fodder, you would add about half clover or alfalfa hay. Shredded corn fodder gets rather stale and monotonous, and clover and corn fodder together makes an excellent roughage.

Mr. King—In this country, I would say clover instead of alfalfa. I do not believe that alfalfa can be grown successfully in central Illinois. I have tried it five or six times.

Professor Curtis—I would put it the other way, by preference. Of course I realize the difficulty you speak of, that many men will meet with failure in growing alfalfa. Yet I know of men who are growing it successfully, and I believe it will be grown to a large extent. But alfalfa is worth a little more for feeding purposes than the clover.

A Delegate—Does not alfalfa do better on a gravelly subsoil?

Professor Curtis—Well, now, the original idea that we had about that was that the alfalfa was adapted, primarily, to the low lying, sandy lands, and we have changed our views about that. We find that the higher lying lands, and especially the clay lands, produce the best alfalfa that we can grow when we get the alfalfa crop established there.

A Delegate—I have seen where they tried alfalfa and it would freeze out, and I was off last fall, and I saw, in this State where there was a gravel subsoil, and dry, they had just the finest kind of alfalfa.

Professor Curtis—Yes, wherever water freezes on the surface of alfalfa in the winter it will kill it.

A Delegate—There was one part of this field that I speak of that was low, and that was nowhere near as good as the high ground, and he had a gravel subsoil, and he attributed it to that.

Professor Curtis—Yes, it grows very well on a gravel subsoil, but you can grow it just as well and produce a larger crop on the heaviest clay soil than on the gravelly subsoil.

A Delegate—You said, awhile ago, that silage was good food, and I believe it, because you said so and because my experience tells me so. But I am feeding silage to feeding steers, steer calves and such. Of course, I am feeding for beef. Now, what am I to do when the thermometer insists on hovering around below zero for a week or so at a time?

Professor Curtis—That is one of the difficulties you will encounter in feeding it to beef stock. The dairyman does not have that trouble. But it is a difficulty with silage for beef stock. I do not know. There is not any way that you can remedy that, perhaps, without having a warmer enclosure. Then, you don't need that for fattening steers. I don't know that you would have serious trouble for more than thirty or sixty days at the outside. In weather like this, you have no trouble, do you? It is only such weather as we had a week or ten days ago.

A Delegate—Have you any experience in this white clover; the feeding value of it?

Professor Curtis—Well, we always think that we get white clover enough without introducing it in our pastures.

A Delegate—Do you know anything as to the feeding value of it? Have you had any experience in that line?

Professor Curtis—Only in a general way. Of course we have never cut it and fed it under exact conditions, where we could feed so much, and know exactly what we are getting in the way of returns. The only way I could state would be in a general way from stock that are grazing it in the pasture. We all know that you don't want it at all for horses. It is better suited to cattle and to sheep, but, as I say, we have always felt that we could get enough of it without cultivating it or introducing it in our pastures.

Mr. Glover—I might help you in a general way there. During the summer of 1903, I never saw as much white clover in the pastures in northern Illinois, or in any other state, as we had then. And during that season of 1903, farmers reported to me that never had their milk flow kept up so well as during that time. And the only reason I could give was the white clover that was in the pastures. Take that for what it is worth.

A Delegate—Isn't it a fact that in these countries that you speak of, more particularly in England, that they do not think that they can afford to pasture any land at all? Don't they depend on what we call soiling; cutting feed and feeding in the lot, and keeping the stock off from the grass land, or the pasture, as we call it, thinking that they must do it to economize the surface of the land? In that way they can carry a head to the acre, summer and winter.

Professor Curtis—That is true, Mr. Williams. They do a great deal of that, but they also maintain a large portion of their farms in grass. William McCombie was known as the grazier king in Scotland; and while he was the greatest Angus breeder in his day, he was a greater feeder of bullocks. If you will go today to those best farms—to Willis's—I speak of that simply because we know what kind of stock he is producing—if you go to him in Southern England, you will find that he has land there that has been in grass for centuries; no man can tell when there was a plow in it. And the one thing that strikes the American visitor more forcibly than anything else is the magnificent and luxuriant growth of grass that you will see in the pastures of Aberdeenshire. Of course they do a great deal of this soiling, but that is simply to supplement their other crops and feed products, and they still have their grass lands, which they maintain in a very high condition.

A Delegate—Isn't it a fact that the tramping over of cattle and herds has a very injurious effect upon all grass roots?

Professor Curtis—The matter of drainage of the soil is an important factor there. If it is well underdrained, the tramping will not hurt it, except at rare seasons of the year, when the soil is very fully saturated. And then they adopt this plan, which we can adopt, and will adopt. Mr. McCombie, who is known as the grazier king, had numerous pasture fields. And he would graze one down, and then put his stock into another pasture, and graze that awhile; and shift them around, so that they had a succession of new pasture lands. And we will do that in this country. And we will keep changing them about. If we have a 160 acre pasture field, I am satisfied you can add at least 10 or 15 per cent by dividing that into four lots, and shifting the cattle from one lot to another.

A Delegate—It seems to me, in discussing the comparative value of silage and grass, we made a mistake by taking one or the other. They ought to be companions. The silo ought to supplement the grass.

Professor Curtis—By all means utilize both, and not either one to the exclusion of the other.

Mr. Spies—I wish to ask you about one thing. You mentioned the luxuriant growth of grass in England. Hasn't the moisture much to do with the grass growing as luxuriantly there as it does? I understand it is a land of fogs, and there must be some moisture where there are fogs.

Professor Curtis—Yes, that is true. They have a more equal distribution of rainfall than we have but they do occasionally have a season of severe drought, just as we have, but ordinarily they have more moisture, and a more constant growth of grass during the summer season.

A Delegate—I am from southern Illinois, and I have made a number of trips through Iowa, during the time we have a drouth here, and I have always noticed that you have got nice, green pastures up there, when down near St. Louis, we have not. You might say a pasture sometimes gets as dry as a road. The roots of the grass are there, but they are dormant, And at such times, we are forced to have green feed to feed our dairy cows, and all of our stock, or else feed our winter feed. And there is where the silo is a great benefit. You do not need it as bad as we do.

Professor Curtis—With reference to that point, while it is true, especially, as you say, for dairy cows,, that you need something to supplement the pasture at that time, and I think the silo will come in there, and the soiling crops, that even in a period of dry weather, if it does not rain for a month or six weeks, as has sometimes occurred, if you have a luxuriant growth of grass there, blue grass and brome grass mixtures, and have an abundant supply, so that that soil is not exposed, and does not bake and crack open, the cattle will surprise you in how well they will gain, even during that dry period. Do not put on too many cattle. If it is grazed down so that there is nothing there but the roots, and we come to a dry period, there is nothing to it, and it cannot grow, and the grass suffers. But if there is a surplus on hand, they will do remarkably well on that grass.

A Delegate—If you were feeding a load of fattening cattle on shock corn and clover hay, would you give them all the clover hay they want, or limit it?

Professor Curtis—On the start I would give them all they wanted to eat especially of the corn fodder and the clover hay, and then gradually increase the amount of corn in the ration, and reduce the clover hay. Toward the latter part of the feeding period, ten or twelve pounds of clover hay or roughage per steer daily will be enough.

A Delegate—If you give them all they will eat, they will be apt to eat too much roughage, will they not?

Professor Curtis—The chances are that they will eat more roughage than they need, and towards the latter part of the period you can reduce it.

A Delegate—How do you advise the seeding of blue grass?

Professor Curtis—We have found, all things considered, the surest and most successful method is to put in the grass in the spring. Prepare the ground early, or preferably the fall before. and then thoroughly disk and harrow it and work it up, and sow it early in April, with no other crop; no nurse crop. Then you will be sure to get your crop of grass. But you are reasonably sure if you sow it with rye; fall seeded rye. Then go on in the spring and sow your grass seed, and give it a light harrowing. Next to rye, I think barley is the best nurse crop and then wheat, and oats would come next. But you are always in danger of your grain lodging, and smothering out some of your grass.

A Delegate—Then if it was sown by itself, you would not get any profit of it that year?

Professor Curtis—No; you simply devote your ground to the growing of the grass crop that year, and your returns, the first year, will not be very heavy, unless you have unusually favorable conditions. That calls to mind a method we have been practicing in growing alfalfa. It is not new. They have practiced it in Nebraska and Kansas. That is fall seeding. And thus far the results are very encouraging. The same principle applies to seeding alfalfa as to other grass crops. The surest way is to sow it without a nurse crop. But you don't get very much returns from the crop the first year. We have been plowing just after harvest, preparing a good seed bed, and sowing the alfalfa the latter part of August. Last year we cut a ton and a half to the acre from the first crop of alfalfa, seeded the previous August. And then we cut two other good crops. This last year we seeded again, and the indications are it is going to be successful.

GENERAL SESSION, HIGH SCHOOL BUILDING, 7:30 P. M, FEBRUARY 22.

Director H. G. Easterly of Carbondale, presided.

The first number on the program was a piano solo by Miss Alma Stevens.

Mrs. Edith Bartlett of Chicago then read, "How Rubenstein Played," and responded to an encore.

The next number was a piano and violin duet by the sons of Principal J. Stanley Brown, who were introduced as the "Brown Brothers."

The Chairman—I have asked one that you all know to introduce the speaker of the evening and that is Mr. O. T. Bright of Chicago.

MR. O. T. BRIGHT.

MR. CHAIRMAN, LADIES AND GENTLEMEN—It certainly gives me pleasure to bring to your notice tonight my old time friend and co-worker in the state of Wisconsin. The state of Wisconsin has been a good deal in evidence before the people of this country in the last few years. I think a man would argue himself unknown who did not know about Wisconsin, in politics at least. Perhaps you do not know. however. that Wisconsin's activity in matters of education has been just as pronounced, in matters of legislation having to do with the control of public corporations and also in regard to some matters that are now agitating the State of Illinois.

Wisconsin has produced some pretty good men. They have not all left Wisconsin either. A man who has taught in the country schools and boarded round, a man who has taught graded schools, who has taught high schools, who has taught normal schools, and who has taught Sunday schools, and who has been superintendent of the great state, certainly ought to know something about education. Mr. Harvey reorganized the state normal school in Milwaukee and put it into most successful operation. From that he went to be the State Superintendent of the state of Wisconsin, and, during his administration some of the most important measures ever projected in that state for the betterment of public schools were adopted.

Wisconsin has, perhaps, the best library law, or one of the best that can be found in the United States. It has a system of normal schools that few states can equal. It has provided most liberally for the support of its schools. Mr. Harvey was the cause of the establishment in that state of the first actual agricultural high school, I think, to be found in this country and I do not know but the first one established anywhere. It was unique and in the success of that establishment we are all intensely interested. After four years of most successful work as state superintendent he went out of the office respected and honored by all of the people of the state and became, shortly after, president of one of the finest technical schools of manual training and domestic science in this country at Menomonie, Wis.

And this school, as many of you may know, has a history. I will not repeat it, of course, but will allude to this one thing. Wisconsin has not so many millionaires as the State of Illinois but it has one millionaire that established a school for the girls and boys of the community. The school is most beautifully equipped, most thoroughly equipped and has been in successful operation for several years. Mr. J. H. Stout, a retired lumberman, has furnished the means for establishing and for the support of that school and it is free to those that wish to enter it. The unique part of this performance consists in this, that the school was turned over to the public and is managed by the board of education of the city and there is no string attached to it either. The board of education manages it just as it manages other public schools of the town. It is a magnificent plant; probably the completest thing of its kind in this whole country.

Wisconsin has also, I think under Mr. Harvey's administration as state superintendent, adopted the law permitting the consolidation of the country schools, and the transportation of the children—another measure which we hope will be adopted by the State of Illinois. Altogether, Wisconsin is a pretty lively state, and I am proud of it. I am proud that I can say that I lived in Wisconsin, the state that is up to date; that has adopted so much of what is progressive in the line of education. And I am proud of it, also, that it had such a superintendent as Mr. Harvey; a man that could do the effective, splendid sort of work that he has done, and that we hope he will be spared many years to carry on in this magnificent institution that he is now connected with. It gives me great pleasure to introduce Mr. L. D. Harvey, of Menomonie, Wisconsin. (Applause.)

L. D. HARVEY.

LADIES AND GENTLEMEN—I shall go back to Wisconsin feeling very proud of it, after hearing an old Wisconsin man tell what he thinks of it. But perhaps that is not to be wondered at, when we recall the fact that he lives in Chicago. (Laughter.)

PROFESSOR L. D. HARVEY.

WHAT THE COUNRTY SCHOOLS SHOULD DO FOR THE COUNTRY BOY AND GIRL.

I am to talk to you tonight on, "What the Country Schools Should do for the Country Boy and Girl." When that subject was assigned me, the first question that arose in my mind was, why the country school, for the country boy and girl? Why not say, what the public school should do for the boy and girl anywhere, whether in the city or country? And I thought back a little further, and I said, why not the question, why there should be a public school at all? What is its justification? On what grounds can we justify public taxation for the maintenance of a public school system, city or country?

And I could find no answer to that question, but this: That the only ground upon which the state can justify public taxation of all the property of the state for the maintenance of a public school system, whether that system is utilized by all the citizens of the state or not, is that the state has a right to do what is necessary and proper for the well being of the state. And it is necessary and proper for the well being of the state that those who live within it shall be trained to good citizenship. And in this training for good citizenship do we find the reason for the existence of the public schools. whether in country or in city.

Now among other things, there are four things which I deem absolutely essential for the training of good citizenship. First, there shall be a trained intelligence; second, the establishment of right ideals in the minds of those being trained; third, the development and fixing of good habits; and fourth, a trained will. There are four things that it seems to me are imperative in the development of an American citizen. And I take it that it is the part of the public school, city or country, high school or elementary school, to concern itself with these four lines of effort.

Time will not permit me to discuss each of these tonight. I should like to take an hour to discuss each one of those four lines of activity, which seem to me to concern the public school system. But that is not my theme tonight. I am simply stating this as the basis of what I have to say.

I want to call your attention, now, to the first of the four,—the necessity for a trained intelligence. That is fundamental. It is fundamental, because all of the others in their development depend primarily upon that. Without a trained intelligence, there can be no development of right ideals. Without a trained intelligence, there can be no proper determination of what constitutes good habits, and there can be no proper incentive for the formation of good habits. Without a trained intelligence, little can be done in the training of the will. Therefore that is essential.

That being so, then the question of the training of the intelligence becomes my theme for tonight, and that particular phase of it which applies to the country school in its work for the country boy and girl.

And then I could see when I had reached that far in my thinking, the reason, perhaps, for this differentiation, for this putting the question of what the country schools should do for the country boy and girl; that perhaps there was something in the environments of the country boy and girl not to be found in the environment of those living in the city or village, which furnished a different sort of material, a different kind of incentive, and a different demand, that would be utilized in the training of this intelligence. And thus I could see that perhaps we might expect to find something different in the country school from that which we find in the city school. Not that our ends are different; they are the same. They are the development of good citizenship. But that our material—not the boy and girl, because boys and girls are very much the same the world over—not that; but that the advantages afforded the boy and girl, the environment, the things which concern him and her today, the things which are likely to concern them in the future, are different with the boy and girl reared and schooled in the city, and the boy and girl reared and educated in the country. Because, while we recognize that there is a movement from the city toward the country—small, limited—and a larger movement from the country toward the city, still it is probable that the majority of both city and country children will pass the greater portion of their lives in the environment in which they were born, or in a similar environment. And therefore there are different demands made by the life and activity and the material things about them which makes the education somewhat different on the side of the training of the intelligence.

We have been apt to think, and have been thinking, in our educational work, that the material which could be utilized for training the intelligence was to be found almost exclusively within the pages of the book; that the child ought to be concerned, from the time he entered the school until he left it, with a consideration of what other people have said, and what other people have done; that he was to commit to memory a large mass of detail of what other people have done and other people have said, and what had concerned them in their activities; that he was to learn something of the development of civilization and of the industries of the race, by reading the records of the past. But always and forever, the task set for him to do was found on the pages of the book. And it is only within recent years that the educational people have been waking up to the idea that not all of human knowledge is to be found within the pages of books; not all the material put into the text books is necessary for the proper development and unfolding of the human mind; and that a large amount of it that is put in them, and that you undertake to put into the heads of the pupils, is a positive damage. We are beginning to recognize that. Educational men have been a little slow to grasp that. They have been a little afraid of the word "practical" in education. They say it is going to lower your standard; that if you introduce the practical side—the dollar-and-cent element—it is debasing and degrading. Perhaps so; but after all, the bread and butter argument is the one that appeals to most of us three times a day. And it appeals to the people who have to furnish it. And after all, in the training of the intelligence, we must recognize this—that in order that a person's intelligence may be trained so that he shall be able to support himself and those dependent upon him, that he shall be a self-respecting member of society, there are things necessary to be done that shall make him capable of utilizing his power, mental or physical, to productive ends. And if he does not do that, then he is of little use in the world.

It is not a question of what a man knows, and it is not a question of what he has learned; it is not a question of what degree he has from the university that determines his usefulness. It is a question of what he does in this world. It is not a question of what he can do, because they are many people who can do and never do. But it is what the individual does. And the training which the public school should give him in this direction of unfolding and developing his intelligent activities is a training that looks toward positive results; something that he shall be able to do.

And so, I say. we have been thinking in later years, and today the people are thinking far and wide as never before, that somehow or other we must get into our school system something of training that shall fit the child for doing something in the world.

And now, before discussing the question farther, as to what the country schools should do for the country boy and girl, let me ask your consideration for just a moment as to what it does do for the country boy and girl. And if I had the time, I should like to discuss the other side of the question, of what the country boy and girl does for the country school; and I should like to go a little farther, and get right at the root of the matter, and discuss the question of what the country boy's and girl's father, who pays the taxes, does for the country school, and what he does not do for the country school. [Applause.] Because, in the last analysis, the question comes right back there. The country school will do for the country boy and girl whatever the fathers of the country boys and girls demand shall be done and are willing to pay for. [Applause.]

Let us see what the country school does do for the country boy and girl. It is carried on for varying lengths of time. I do not know what it is in this State. How many months?

A Delegate—About an average of seven, I think.

Professor Harvey—A minimum of six to nine months in the year, twenty days in the month. You will find in attendance in your country schools, if they are like most country schools in most states with which I am acquainted, an enrollment of possibly 50 per cent of the school population. You will find if conditions are favorable, an attendance of 50 to 60 per cent of the enrollment. In other words, you will find from 25 to 30 per cent of the school population regularly in attendance. That is one thing it does, and a large thing it does not do. It does not get the country boy and girl into the country school continuously through the school year.

Another thing. You will find a large proportion of the country schools with an attendance so small that there is a total lack of the stimuli which are so essential for the spirit of emulation; for the arousing of the ambition of the pupils and of the teacher to get the best results. I think you will find that. I think you will find that at least one-third of the schools in your own State—possibly I am stating that too large—are too small to be good schools. You will find another thing right in connection with that. You will find, generally speaking—not always—but generally speaking, you will find that the small country school pays the lowest wages for a teacher, for this reason: They say, our school is small, and we can not afford to pay as much as they can in District No. 5, where they have fifty or sixty pupils in the school, so we must get a cheap teacher—and they do, in every sense of the word. The poorest teachers, other things being equal, are the ones that receive the lowest salaries. That is not always true, but generally. So in about one-half of these schools, there are too few pupils to do good work, and the teachers are the poorest in the business, practically none of them with any professional training for their work.

You will find another condition in a large number of those schools. You will find them lacking in everything that does for comfort and adornment of the school room, to make it a place where children love to be, and where the very being there will have an elevating influence upon them. You will find it lacking in the necessary essentials of equipment. In other words, you will find the poor teacher, with her small school, without equipment to do the work which ought to be done. You will find in your larger schools a somewhat better condition. And yet you will find, in most of those schools, salaries so small as not to command the services of those professionally trained for the work. You will find there the people whom they will not employ in the cities. The city boards of education will tell them, "Go out in the country and practice on the country boy and girl, and when you have won your spurs there, then come to the city and we will take you." I am saying nothing against those people; I am simply stating the facts.

And the country boy and girl are getting their education in these schools then, under these conditions of irregular attendance, and attendance through a small number of years, irregular as it is, with teachers without practical training to do their work. You will find another thing. You will find that in a great majority of the schools, there are few pupils above the mature age of 14 years. In my own state, in one county, I sent a man into that county to travel the county with the county superintendent for a week and visit schools, and address the people of the county in the evenings. He reported to me at the end of his visit that he had visited eighteen schools, and in fourteen of these schools he found but ten pupils 14 years of age; and that was in the winter time, when the big boys were all supposed to be in school. Superintendent Kern has told me today that in his own county, Winnebago, with 106 single-room district schools, they have in those 106 schools 168 boys who are 14 years of age, and 120 girls 14 years of age. Where are all the others? At first thought, you will say they have gone into the city or the village schools. They are not there, my friends, unless your State is very much different from Wisconsin, and I do not think it is, in that respect. I made a careful census of the school population of Wisconsin three years ago, and I made this discovery: That the number of country boys and girls, taking all the non-resident pupils attending high schools, that is, those who did not live in high school districts and assuming that they all came from the country, was 1.6 per cent of the school population of the rural districts. That is to say, less than two in 100 of the country boys and girls living in the country were finding their way into the city schools to get anything beyond that which the country school offered them.

Those are the conditions which confront us today. President Roosevelt struck a popular chord when he put it as his sentiment that under his administration every man and every interest would be given a square deal. And I submit to you, ladies and gentlemen, that under the conditions I have stated—and I think I have stated them correctly, as you will agree—under those conditions, I submit to you that in the preparation for life, in the development of American citizenship and the opportunities for it, that the country boy and the country girl are not getting a square deal. [Applause.]

If that be so, what are you going to do about it is the next question? Are the country boy and girl entitled to a square deal, or not? I heard today some very delightful things said, over here in the church, about how the country furnishes the intelligence, the brains, the statesmen, the business men, those who control the great industries in the cities—and it is true. I did not hear them say, what I often do hear said, that that shows what the country schools can produce. "That argues that the country schools are all right, because they furnish the men who shape things, and do things." Let us not flatter ourselves, ladies and gentlemen. Let us not imagine for a minute that that is true. Let us get at the facts in the case, and say that this is the truth: That these strong, rugged, sterling, independent characters who go from the farm and farm life into the city, and by the very ruggedness of their natures develop that strength, that integrity, that vigor, that manhood which carries them to the front, are doing it, not because of the training of the public schools, but in spite of it. [Applause.] It is not what the country school has done for them. Oh, no! Do not forget, my friends, that for every one of those whom you can pick out in your cities who stand as beacon lights, there are scores who have come from the country, and who have become lost and submerged in the city. Of them you never hear. They have not had a square deal. They were not strong enough, and rugged enough, and vigorous enough to demand it and to secure it. The others were. That is the difference.

And so I think that we ought to have a better set of conditions for the country boy and the country girl. Now, what are they? What should the country school do for the country boy and girl? I have said it should do four things. What should it do in the training of his intelligence? Shall it keep him busy, from the age of 6, when he enters the school, until he leaves it, poring over the books, as was said today by Superintendent Bright; working over the same book, once, twice, three, four, five times? Shall we keep him at that? Can we imagine for a moment that we can put these children, at the immature age at which they enter the common schools, at work at a desk six hours a day, on mental work, dealing with abstract things put upon the printed page, and get effective mental activity during that time? We are just waking up to the idea that it is not a possible thing, either for a child or an adult. We are just coming to realize that the Almighty has made human beings so that they demand some other form of activity than that which is called into being by the stimulus afforded by the printed page that is put before them. And what has it been? A little work with a lead pencil and a piece of paper, and that is about all, except the physical activity which the bad boy displays, which is simply a symptom, not of total depravity, but of an innate tendency which he is not responsible for, and he is doing the best he can.

Just now, we are beginning to recognize that there is a kind of training which we have left out of the public school system—a training of the hand. Is it essential to give that training? Ninety-two out of every 100 of the boys and girls who complete the eighth grade of the public school—and that includes the country and city boy and girl—ninety-two out of every 100, according to reliable statistics. will earn their living by their hands. Now, if that be true, think of the large number that have never completed the eighth grade or the country school work, and that a still larger percentage of them are to earn their living by their hands. And then think of the school system of the country that furnishes, during these early years of the school life, no opportunity whatever for the training of the hands, except that which is afforded on the play ground, or in the marring of the walls and the desks and seats of the school room. No efficient, well directed training to develop the power of this marvelous tool, the human hand, so that it may do the things which it is set to do; so that when the child goes out from the school, he shall be able to use that hand effectively; more skillfully than he would without this training; that he can direct it to new and various uses, with greater skill and greater facility than he could possibly do without it.

Then we are learning another thing; upon some of us schoolmasters it has been forced—it has been a little hard for some of us to take the dose, but we have done it with the best grace we could, and we have discovered, after all, the education of the child is not entirely in the school room. It is very fortunate for the child. It is a piece of great good luck that he learns a great many things that the school teachers never teach him. School teachers are quite apt to forget that. We are apt to think that if we do not teach them everything that they ever need to know, that we have missed something that ought not to be missed. And we have applied that fact in the school room. We have said, now, if these children do learn many things outside the school room, through the common experiences of life, in coming in contact with the material things about them, and dealing with those things in an accidental, incidental way, why not, in a directed, orderly way, put some of those activities into the school course of study, and give an opportunity for the play of them, and thus direct them toward definite ends through training? We are coming to see that an individual may be set a task with a saw or plane or hatchet or hammer or some other tool, that he may be set a task to do which shall demand not only the use of the hand with skill, but, back of that, a mental activity of as high an order and of as great usefulness in life, as any form of mental activity ever demanded by any of the work in the regular course of study in the school. And thus we see why the demand is coming today, all over this land, for work in our public schools which shall train the human hand. because there is no well directed effort on the part of the human hand which does not have back of it, and co-ordinated with it, a well directed mental activity; and whenever there is a design worked out by hand, there comes a training of the mind: a training of the mind which concerns itself with the material things; with the activities of life; not with dead records of the past, but with the things that the child will have to do, or may have to do; things that are being done, and that the world demands shall be done.

I submit to you that kind of training is what both country and city boy and girl need. And they need it in order that they may fit themselves to earn that livehood which will make them independent. But, in order to do that some other things are demanded. It means a modification of the course of study. It means that we must put into it something that is not there. It means that for the country boy and girl there are interests and activities which do not appeal to the city boy and girl. And these interests and activities incident to farm life, to the animal life upon the farm, and to the plant life; to the varying activities by which this life is being utilized, are the things which concern him, and which should be made a matter of study by him. And thus it is that we are finding the demand sweeping over the country for the introduction of the study of the elements of agriculture in our country schools. We find that demand, in some states, taking the shape of legislation mandatory in its character, insisting, under the sanctions of the law, that agriculture shall be taught in every district school of the state. We find, in other states, requirements that the teachers shall pass an examination in this subject in order that they may secure a certificate to teach, for the purpose of arousing and awakening public sentiment on this matter. And this comes about because the men who are at work in our agricultural colleges and experiment stations and in your farmers' institutes here are bringing to the farming population of this country the results of the work on those experiment stations. They are bringing to them results which mean money; dollars and cents; mean betterments; mean improvements in conditions; greater opportunities; and they are bringing to them the intelligence that, underlying this business of farming there is a scientific basis broader than underlies any other field of human activity; and that the farmer finds in his work, or may find, an opportunity for the widest range of knowledge in the whole field of science, that he can bring it to bear to practical ends. And more than that, it may not only be brought to bear for practical results, but it enlarges his views, and his interests, and opportunities as a man. And it is that which is awakening the public to this idea, that this kind of instruction ought to be made a part of the elementary courses in our public schools; not alone for the boys, but we are coming to see that there may be something done to train the girls, to fit them for their future activities in life; and that the study of history and grammar and geology and arithmetic and algebra, no matter how valuable it may be, does not give all the training that the girl will need in her own home, later on. And the body of knowledge is being developed and organized, and put in shape and in pedagogic form, so that we are coming to see that a large amount of it can be taught in public schools. And it ought to be taught. But some people say that it may be better taught at home. Beg your pardon, but I do not believe it—that is, not in many homes. [Applause.] There are two or three reasons why not. One is that the girls are so busy, nowadays, in going to school and attending to social duties and other things, that they have no time for learning things at home. Another thing is that the mothers have no time to teach them; they are not going to school, but they have no time to teach them; and then, if the ladies were not here, I should say that a large number of them do not know how to do it themselves. [Laughter and applause.] I am going to get right out of the city immediately. [Laughter.]

You will pardon me for saying that, and you will understand that I mean no discourtesy. I mean to say this; that I have sometimes sat down to an elegant repast, served in the most delightful manner by the hostess, who prided herself upon her culinary skill, and with just grounds; the only misgiving I had, from beginning to end, was, what would be the condition of the inner man when I had finished that meal. I have been thinking a little about this matter, and looking it over just a little bit, as I have had occasion to do for the past four or five years. I have been attending farmers' institutes and wondering why no more attention is given to this matter. I have heard these institute men talk about a balanced ration; and sometimes, when I get out in the country where I am not known, I talk quite learnedly about a balanced ration for stock, myself; [Laughter], but I have not heard many of them say much about a balanced ration for the other animal—man—and I have wondered, sometimes, whether it is not just as important that the boy and the girl, and the father and the mother should have a balanced ration, as that the hogs in the hog yard should, or the sheep in the sheep pen, or the cattle out in the yard, or the horses. There is only one difference in the world. For the latter is a matter of business; it is a matter of dollars and cents, that we adjust their food properly; that we get the right elements together for the purpose for which we wish to give the feed. Because it means money; it means more milk from the cow; it means more fat on the beef animal and the hog; it means more dollars and cents. Therefore it is worth while. That is why these gentlemen talk of the balanced ration for the farm animals. It is worth while. But who is talking it to the girl who is to prepare the ration for this man, this child? Who is talking it to her? What does she know about it? She knows about how to make all these fine and elaborate dishes that are so beautifully arranged upon the table. But when you take the question, what is it for? What is in the stuff? How much of that which will build muscle is there? What will it do? That is a thing she has never heard of. And perhaps, in the whole elaborate dinner, as it is served, there is not any proper adjustment of the food materials there for the purposes for which food should be taken. I submit to you that it is worth while to teach, not only the country girl, but the city girl some of these things, as well as to have her learn a few more pages in English grammar, or even a little Roman history. [Applause.] I think the human race will be better off, if we should cut out a few terms' work in ancient history, and put in a few terms' work in discussing this problem of how to eat, what to eat, and how tô get it ready to eat. [Applause.]

There are a whole lot of other things. I have not time to discuss those. You know what they are. Some of you heard that matter discussed over at the opera house, very fully and completely as to what this field covers, and we are coming to think we can teach some of these things in the public schools. We know we can. Up where I live, we have been doing it for years. We are not talking about it. We are simply doing it. We are training our girls, city and country girls, so that they can tell you what a balanced ration is, and what are the elements that make it up, for boy and man. And, more than that, they can prepare it, and serve it as it ought to be served. [Applause.] We are training them to know what kind of a ration the sick child or the sick father or the sick mother can bear, and how to prepare that, and how to serve that. And when we remember that these girls of ours in the public schools, city or country, a little later on in life are likely to face the problem of caring for some loved one, whose life depends more upon skillful nursing and proper feeding than upon the skill of the physician, then we realize that this thing, taught as it ought to be and can be in the public schools, is worth while. [Applause.]

But, my friends, you cannot put all these things into the country schools under the conditions that I have indicated to you. [Laughter.] That is what you cannot do. Now, what the country school should do—should do—what it does do—oh, what a gap! Can we close it up? It is up to you, you people who live in the country. Yes, or no? Of course, when we begin to discuss this question, the first thing that I hear is, "Well, won't it increase taxes?" I hope so. [Laughter.] I hope so. "Well," you say, "you are a schoolmaster." Yes, I am, and I pay taxes, too. I am unfortunate enough to have to pay taxes in four or five counties in my state. I know what the tax rate is in quite a number of them. I never growl when it comes to paying taxes for the education of boys and girls, and I think it is a good investment. I am talking from the standard of a taxpayer, not of a schoolmaster, just now. And I want to say to you that you cannot teach the practical things which concern doing, and which concern the development of the intelligence of the individual toward the effectiveness in life, except through people who have been trained to teach them and who know what they are themselves. And you cannot get that sort of talent for $15.00 or $20.00 a month. And if a boy or girl in the country is to have a square deal in the preparation for life, they have got to have schools with adequate equipment, and with teachers trained so that they are able to give this work. And that is not all. You cannot give all this work in six months, nor in the first six years of school life. A good many school teachers I know want to push everything down into the first three years. You ask them "Why?" They say so many children leave after the first three years. and so they want to give them a college education in the first three years. Just recognize that you can do just about so much the first three years, and so much the next three years, and you cannot do any more, and it is not worth while to attempt it. We need to realize that if we are going to give our boys and girls a square deal in this world of ours, a fair opportunity in the race for life to do what they ought to do, and to make of themselves what they ought to make of themselves, and what God intended should be made, we have got to give them a little better opportunity, give them a little more time, leave them in the school a little longer, and we have got to have better schools. How shall we get them?

I heard Superintendent Kern say something of the consolidated schools; of the closing up of these little isolated country schools with six or seven pupils and the old school houses that are not fit to keep sheep in, closing them up and bringing the districts together, and bringing them to a modern building, and getting into those buildings teachers with training for their work, and making some provision for manual training and domestic science and agriculture and some other things that touch the affairs of life. He says it is done. He says they are doing it in Seward; and he might have said they are doing it in twenty states of the Union. It is not a question for argument any more. It is done, and it is being done more and more rapidly all over the country. It is a proposition that has come to stay.

People say you cannot get the boys to school in the morning; you cannot get them together. This morning I woke up and looked out of my berth, the other side of Chicago, and I saw a car standing on the sidetrack, and there was a team beside it, and another one back of it, and another one back of them and two rows on the other side, all waiting, and something covered up in the wagons, and presently I saw milk cans. Seven o'clock in the morning and the milk cans had been gathered up, and were there on time, and were ready to start on schedule time. They could get the milk cans there. [Applause.]

Well, I wonder if a milk can is a thing more difficult to transport than a boy or a girl. I wonder if it is so much easier to gather up the milk cans, and get them—and by the way, each farmer had his own milk cans, I judge. They could get their own milk cans to the train; could they get their own boys and girls to the school? That depends on which is more important, the milk product or the human product. That is the question. This thing can be done, and is done, and see what an opportunity it is! Instead of your little isolated district of today, with a half dozen or a dozen pupils, with a poor teacher, poorly trained, poor attendance—instead of that, consolidate these schools with one equipment, one meeting point; graded schools instead of twenty-five or thirty recitations a day, eight and ten a day. It is a simple business proposition. Does it pay? Does it pay to send your children to school at all? In many of the district schools of this country today, I believe it not only does not pay, but it is a positive loss; a loss in intellectual vigor and inculcating bad mental and moral habits; and I would rather my children would never step inside a school room than to go to some schools that I know. If it pays to send them to school, it pays to send them to a better class of schools, and these consolidated schools will furnish better conditions. The increase of cost will not be very much. The statistics from twenty states in the Union say that there is a positive lessening instead of increase in cost. But you say, "We can keep down cost by not having so many attend school." Yes, that is right. You can do that. You can keep down the cost of caring for your calves by killing off half of them. [Applause.] You can keep down the cost of your horses by selling half of them. It does not cost as much to feed the others. You can keep down the cost of raising a family by killing off half of them. You can keep down the cost of their education by not educating them. But you will pay out what you thus save in constantly increasing demands through the legislative bodies for appropriations for the maintenance of prisons and reformatories; of institutions for caring for the insane and the feeble minded. That is where you will do it. You will do it in increased cost of the police force. You will do it because you are not training American citizens to the rights and duties of American citizenship. That is where you will pay for it. [Applause.]

With this kind of a school we can do much more for the country boy and girl than we are doing today. They are solving that problem in twenty states in the Union. In some of them this work has been going along for twenty years or more. There is no question about it except that they have not introduced some of these practical things which shall employ the child in physical activity, in training him to do something. No matter what he does later on in life. It is not a question of making farmers. That is not it. But we train the boy on the farm to do things which concern him in the farm life. No matter if he leaves the farm that training has trained his intellectual faculties and has given him a start in preparation for the work he is to do, than which there is nothing better. So the argument that we are making farmers or mechanics does not lie against this proposition. It would not be a very serious thing if it did. But, my friends, I want the country boy and girl to have a square deal all the way through. I do not want to stop with the consolidated school.

The consolidated school means a graded school with perhaps a year or two of high school work beyond it. That is what it will mean, ordinarily. In some cases it will develop and grow into a high school with a four years' course. The country boy and girl today who go to a city high school do not find the kind of training and opportunities which they need to fit them for life in the country. You will say, "Are you expecting them to stay in the country?" I hope they will stay, some of them. I hope they will not all stay because we need some of them in the cities. We must have them there. But I will tell you what I would like. I would like to give them such a training concerning the opportunities and activities of farm life as would lead them to see the possibilities in living upon a farm; that would lead them to see the opportunity for intellectual activity there as well as on the forum; as well as in the professions. I would like to have them see that there is an opportunity for well directed effort and large returns for that there. I would like to have them see that there is an opportunity on the farm for some leisure and for some comfort in life.

I left the farm and I left it because I did not like it. Why? Well, it was not because of the hard work. There was enough of that! It began while the stars were yet shining in the morning and it did not end till they shone again at night. I know what long days and hard work mean. But that was not why I left the farm. I left it because hard work was all there was on the farm. Because there was not, at that time so many years ago, the thousand and one things that are available to the farmer today and some of which are sealed books to him because he has not had the training which makes it possible for him to realize what is in them. I left because none of these things were there then.

But the farmer's boy today, with the kind of training that it is possible for him to get, has a different outlook upon life. He has independence before him; comfort before him; he has leisure before him; he has the comforts of the city, and many more as possibilities, before him.

And so I would like to have for the country boy and country girl a class of secondary schools, designed especially to give instruction in agriculture, in domestic or economic science and carrying on some of the academic work as well. We have two such schools as that in Wisconsin. What we are undertaking to do there is this: To give the country boy and girl, after they have gotten all they can out of the country school, an opportunity in their own county, at home where the cost of going from their home to the school centrally located will not be great; where they can return to their homes Friday night and come back Monday morning to have practical instruction in the things which concern the farm life and the reasons for those things; for the elementary science which underlies these things. So when they go home and talk with the farmer upon the farm as to the different processes employed they are able to give reasons why certain processes are wise or are not wise.

They are able to do things which the farmer cannot do. They are able to understand things which he does not understand. They are able to explain things which he has been doing but did not know why. They are becoming acquainted with the bulletins that are being sent out from the experiment stations all over the country. They are becoming acquainted with those which give practical suggestions to farmers. They are taking them home to the fathers. They are interesting the farmers in those things and interesting the mothers in many of those bulletins which give material of interest to the mothers in the homes. They are being trained to do things which are suggested there so that when they go home to suggest this thing to father or mother as a thing proper to do under certain conditions, and the people, with the conservative natures that most of us have when we get to be fathers or mothers say, "that is a new thing; I don't know how to do that," the boy can say, "I know how to do that; I have learned." And he is able to do it. More than that, the school has become a center of influence for the uplifting of the business of agriculture and home making for an entire county. The farmers of that county understand that that school is their local experiment station; that it is not undertaking to carry on the extended research work that is carried on in the state and national experiment stations but it is doing the practical things which concern the farmers in that community, so that they are coming to the principal of that school almost every day in the year presenting these problems to him and asking for help in their solution. They believe in that school and they believe in giving their boys and girls an opportunity to get that sort of an education.

We have four or five hundred people in our agricultural department of our State university. Yes, but we have thousands and thousands of boys in the State who are as much entitled to an opportunity to get that education as those who are there, but who could not be cared for if they went there. We are trying to bring to them the opportunity to get that sort of training which will make them better men and women, and it is that class of schools that we must have for the country boy and girl, and which are not now in existence; which I believe are essential, in order that the country boys and girls may have a square deal in life. The city high school does much for them, but it does not do for them the things they need to have done; and I do not believe it does for them, in the way of mental training, in the way of development of mental power, what that kind of work does. This work is not dealing with abstractions. It is not dealing with the history of the past. It is dealing with the things of today—those which concern people now; the activities of life out of which are coming the development of our civilization and our industries. And they feel that they are part of it, and therefore their interest lies in it. And that which we are interested in is the thing which we do, and into which we put our whole soul.

But I want to say to you ladies and gentlemen tonight, that the country school should do for the country boy and girl whatever is necessary to be done to make them independent, self respecting, useful American citizens. It must first give them a mastery of themselves. It must first make them able to earn their livelihood, and able to support those dependent upon them. And the course of study which will do this must have injected into it something that shall offer an opportunity for doing something; for doing something with the hand; with the hand, controlled by the mind. Not doing it on beyond the stage where it becomes automatic, for then mental activity ceases. But up to that stage, mental activity is ever present, and development is coming from it. We need that in the public schools.

But some of you say the courses of study are overcrowded today, and the children are being killed. Yes, that is true; and I want to put this in to keep them from getting killed. I am in the habit of saying this sort of thing would be worth all it cost, if it had not any other value than this—that it makes it necessary to put out of the courses today some of the useless stuff that is there. [Applause.] But it has a higher value. It has a value for training and development. And there is no trouble about putting out other matter. It is not that we have too many subjects in our schools. I hear people talking about this, that or the other fad. It is not a fad. It is the waste of effort and energy in doing a thing which is not worth doing after it has been accomplished. Let us eliminate that.

Let us remember this: That the child of 6 or 10 years of age can not work effectively six hours in the day with his mind without physical activity. Why, you take the child in the home, and the mothers here will tell me that day in and day out, the child's cry has been, "Mamma, what can I do? What can I do?" It is first one thing and then another, and the little thing wearies of it, and "Now, what can I do, mamma?" It is not, "What can I study?" No, he never asks that question. But, "What can I do?" He wants to do something. His physical nature demands an opportunity for action. And we take him into the public school and say to him now, in answer to that unspoken query, "What can I do?": "Sit still; keep quiet; study." Instead of that, I would put in there an opportunity, during some years, for some work of the hands. Give him a chance to do something. Give him a chance to get up; to take hold of something besides books and pencil and paper, and to concern himself with these physical activities; his mind directing the thing to be done, and the hand working it out; learning the great lesson of self control; developing will training and will power. That is what comes of it, and that is what we need in our country schools and city schools as well.

But, as I said before, you cannot have these things without paying for them, and the question is, whether it is worth while, after all; whether the country boy and country girl are worth saving; whether they are worth giving an opportunity to. You ladies and gentlemen attend these farmers' institutes here in Illinois, and Wisconsin, and all over the country. You came together to discuss these questions which concern the activities of the farm; you spend time and money to do it. What for? Because it pays. Because there is money in it. You see it. There is only one business that I know of under the shining heaven, that is run on the basis of not caring whether it pays or not, and that is the education of our children. When it comes to the breeding of horses, we study every pedigree; we study the breeds and the cross breeding; we study the feed and the feeding, and the care, and we put money into blooded stook, and we get rid of the old stock. Why? There is money in it. It pays. We get farm machinery. It is not worn out, but there is new and better machinery comes, and we throw aside the old, and get the new. Why? It pays. The manufacturer in a great industrial establishment finds that his machinery is a back number, within a year, perhaps, after he has put it into the factory. It has not been used to any considerable extent, but a new machine has been brought out, which will do the work better, more effectively, and cheaper, and out goes the machinery, costing thousands of dollars, and it goes into the scrap heap, and he replaces it with new and more costly machinery. That is done all over this land, wherever business men are engaged in successful industrial enterprises. Why do they do it? Because it pays.

There is not an activity, then, in which we do not do this thing. We get the best stock—because it pays. We use the best feed—because it pays. We get the best machinery—because it pays; because there is money in it. But my friends, up in Wisconsin—I do not say this of Illinois—but up in Wisconsin, when it comes to the education of our children, we say we don't have to get the best for them. We don't have to get the best teachers that money can procure Why? Because there is not any money in it. We are willing to let them take their chances. That is what we do up in Wisconsin. You don't do that down here. I am speaking of this just simply to get your sympathy. [Laughter.] We say it is not necessary. We say it by our actions, at any rate. We are unwilling to get anything for the public school. We are willing to let the building go until it is a disgrace to civilization. It goes without equipment, but our farms are equipped with the latest and best. Why? Because it pays. But we demand of the school teacher that she shall make bricks without straw; to train the boys and girls to manhood and womanhood, and do it without the merest element of equipment essential for doing it. And we put these children in charge of people themselves untrained, with no ideals, with no conception of what it means to train and develop a human mind. We do this—why? Not because we do not love our children. No! But because we are thoughtless. Because we do not see the immediate returns in dollars and cents. But there are some returns that are worth more than money; some which cannot be measured by the dollar standard. They are returns in manhood and womanhood; in better citizenship; in the unfolding and development of a human mind; in the possibilities that come because of that. And I want to appeal to you, fathers and mothers, to take this thought home with you: If it pays to get the best of stock, the best of machinery, the best of farms, the best of everything where the dollar is concerned, will it not pay a hundred fold more to get the best of everything where the future life and welfare of your own flesh and blood is concerned; where you are concerned with the making of American citizens? And remember, you cannot do that faithfully, without using the same business methods that you apply everywhere else in life, to get the best of everything that will make to that end. [Applause.]

Chairman Easterly—This subject will be continued tomorrow evening by Prof. O. T. Bright. Dean Eugene Davenport of the University of Illinois will make an announcement after which we will stand adjourned.

Dean Davenport—It is a matter of very great regret that Dr. E. J. James, of Illinois, is not here to take his part upon this program. He would have been here if it had been possible. He has been ailing for more than two weeks. He got off his bed to receive the delegation from Springfield, went back to bed after that hard day's work, and has not yet recovered. I wish he had been here. He had some things to say. There will be future opportunities, I know, for him to meet you. But I want to distinctly interest you in your support of the new president of the university. You know he is a western man, born in this State. He knows the west. He is interested in the west; in its development. And I want you to help him in this new work that he has taken upon his hands, in connection with the State University. When you know him, you will love him. When you know him, as some of us have learned to know him in only a few weeks, you will feel assured that no mistake was made when his selection was decided upon. You will meet him, I am sure, before long, and I hope in a short time you will realize that we have at the university an earnest, conscientious and intelligent advocate of agricultural education in this great western country. [Applause.]

General Session, Opera House, 10:15 A. M., Feb. 23.

President Wyman—I now take pleasure in introducing to you, Mr. T. E. Orr, of Pennsylvania, who will talk to us about

The Little Things In the Poultry Business.

Mr. Chairman and Friends—You will certainly admit that it is very embarassing in carrying out the program which has been prepared by the officers of this institute, to inject upon an audience so deeply interested in the subject which Professor Haecker has been bringing before you, a topic so generally ignored, and as a rule, receiving so little consideration at institutes as mine. I am very glad, however, of the opportunity of having the hen recognized on the program of this great institute and of having the opportunity of talking to these farmers and farmers' wives, assembled from all over this great State of Illinois, on a subject which seems to me should be interesting to them because of the fact that the poultry product of the State of Illinois stands along with Iowa and Ohio—over $20,000,000.00 per year turned into the pockets of those same farmers in each of these three states, and if those statistics were more complete and accurate, I firmly believe that the poultry product of your own State last year amounted to $25.000,000.00.

T. E. ORR.

It will be impossible to more than merely hint at a few of the little things that make up success or failure of poultry on the farm. And I might say that poultry other than that upon the farms or ranches is not deemed of sufficient importance to be recognized at all in statistics. You of the cities, towns and villages, producing eggs and poultry of excellent quality are not recognized at all in those statistics to which I refer.

It would be interesting to spend a few minutes in discussing many of the little things; first of all—the little diseases that stand oftimes in the way of our success. Of those little diseases, we have roup, simply a cold aggravated by conditions unsanitary, then running into more aggravated forms of that same disease, cankerous condition of the mouth, throat and nasal organs.

It might be interesting to go over and discuss some of the remedies of this and other diseases, and to treat of those enemies found about the poultry yard—those little enemies so small we do not recognize them by name. We do find them about our persons, it is true, after we have visited our poultry house at night to select a fine fat fowl for the next day's meal. Some of those external parasites of which no less than twenty-five are known to infest our domestic animals, and no less than three varieties have been found upon one fowl at the same time.

It might be interesting to go farther into the subject and treat of the internal parasites that affect our fowls by bringing on diseases. It is known that most of the diseases of poultry do come from and are aggravated by parasitic forms of one kind or another.

Then the subject of tape-worm, which has been pretty thoroughly investigated—there are no less than six different kinds of tape-worms that infest our domestic fowls.

If we had time we might spend a portion of our hour in discussing the gapes—that little worm which finally finds its lodging in the windpipe of the chick, causing it to gasp and gape for want of breath. But these and many other points along these lines have been discussed in the poultry papers so frequently and are so familiar to you, that I should feel compelled to pass them over.

I should like to speak of the little points of feeding, if time permitted; what the feed will result in as to the quantity and quality and flavor of the eggs. I might bring illustrations about this to show that those who have contracts for supplying the most particular and fastidious people of our great eastern states, must enter into written contracts, giving bonds that they shall feed no deleterious substances, no cabbage or onions, lest that flavor be given to the eggs. I might speak about what this food will do in the way of promoting egg production early and what it will do in the way of retarding it. For that is one of the little points in poultry raising that one needs to know. It is easy for a man to push his hens to the earliest production of eggs, but it is also true that he may retard them by feeding and breeding; that is, having them approach the period of egg production too soon; before they are that size which they should reach, he holds them back, and retards their growth and physical developement.

There are points along the little line of the dollars and cents of the business, with reference to putting our production of poultry and eggs upon the market in such a form that the most exacting people are willing to pay the highest prices for them; how the difference of a little care in handling the eggs after the hen has laid them in the nest, means so much; how the cleaning of those eggs and having them put in cartoons all exactly of the same size and color, free from any mark or soiling of the hen's feet upon the eggs, and how that we should no more think of sending an egg to market with a hen track to mar it, than one that we know to be spoiled. But there is no time to go into the little points, even these business points.

And of breeding; the little difference in the shades of males that are used for breeding, the knowledge of the different breeds and of the different varieties of the various breeds of poultry. These are points which ofttimes occupy a poultry institute three sessions per day for two days, where the subject of poultry is given wide latitude and where the people are deeply interested in it. But here, where you are interested in so many other things, I feel it will not be well to take your time for many of these details.

In the days that I spent with you last year at Decatur, and especially in these two days here, noticing this vast audience fill this opera house clear to the roof, and two or three overflow meetings yesterday afternoon, there has been a thought in these meetings that impressed me very deeply, and that is the educational opportunities of the farmers' sons and daughters and how these opportunities may be brought to them. I wish to talk for a few moments along a line which seems to me is connected in a general way with the poultry business, namely—interesting the farmers' son and daughter so that they may be kept on the farm; of getting into our rural schools such teachers as will be able to teach something to our boys and girls that will interest them and hold them there. I have heard in these meetings, much about the betterment of the general conditions surrounding the country school and the great earnestness with which you have talked of those subjects induces me to refer to some personal experiences of my own as a farmers' boy and a teacher.

A good many years ago, more than I will exactly name, I was called as a teacher to go to Posey county, Ind. Most of you have read the "Hoosier Schoolmaster," by Eggleston. It is not an exaggerated book. At Mt. Vernon, the county seat of Posey county, to which I was called a good many years ago to take charge of the high school, I found as wide awake a set of people as I have ever known. But there was a unique character there in connection with that school with whom I came in contact. I was employed by the superintendent of the city schools and went with him down the Ohio river, reaching Mt. Vernon in the evening. To that moment, it never occurred to me that I should have to pass an examination before I could teach school. beginning on the following Monday morning. So, on Saturday, along with forty or fifty others, I assembled in the court house and the county superintendent there put upon the blackboard the questions that had been prepared by the state superintendent for those teachers. The county superintendent had charge of these examinations. graded the teachers and gave them their certificates if found worthy.

It was a hot day. We were sweating drops of ink in the afternoon, and wondering what next. About 3:00 o'clock in the afternoon the superintendent, whose name was Campbell—they called him "Old Tar Heels," because he came from North Carolina (he would talk an hour with you on a street corner arguing with you that the world was flat—just for the sake of an argument)—rapped on the desk to call attention. He said:

"Teachers, I don't think much of this kind of an examination. Until this envelope was torn open this morning before you, I did not know what these questions were. I think some of them are very foolish. But I have a personal interest in this examination. I see by the list of names handed me here that there is one young man in this audience in whom I am personally interested. If he should be so fortunate as to get a certificate from me to teach school, some of my own children will pass under him for instruction this week."

Then he called me by name and said, "Stand up." I stood up (by the help of the desk), and he spent half an hour, as it seemed to me, in looking me over. "Well," he said, "you are tall enough. I don't know anything about what your papers will show, and I don't care very much. But I would like to find out right now whether you have any common sense or not. Will you tell me, when a cow is standing up and wants to lie down, will she lie down hind end first, or front end first? And when a cow is lying down and wants to get up, will she get up front end first or hind end first? And a horse, when he is standing up and wants to lie down, does he get down hind first or front end first? And when a horse is lying down and wants to get up, does he get up front end first or hind end first? And in a storm, does a horse stand with his head or tail to the wind? During that same storm, does a cow stand with her head or tail to the storm? And at night, when sheep lie down, do they lie down on the high ground or on the low ground? Which end of the grain of corn does it sprout from? How many claws are there on the front foot of a cat? How many upon the back foot?"

He continued with a long list of questions of that kind. Well, he must have been satisfied with my answers, for I had not half completed the examination of some of the branches that he gave us, still I got a certificate to teach them from "Old Tar Heels" Campbell.

I felt then and I have felt ever since, that I owed a debt of gratitude to a man who had been my teacher in the common schools. I was born in Virginia, where we practically had no common schools. It was in 1863, before the little State of West Virginia was separated from Virginia. West Virginia was compelled to import her teachers from Pennsylvania and Ohio, and good men came across the lines to teach. One of them who was my teacher for a number of years, Thomas Carothers, a man now passed to his reward. He was a man who believed that the farmer's boy had a right to know something more than reading, writing and arithmetic. He believed that there was something more, too, than the least common multiple and the greatest common divisor. He believed that the boy and girl brought up on the farm ought to know something more than most of them did know about the phenomena of nature by which they, far more than the city boys, were surrounded. He believed it his duty as a teacher of those boys and girls to start with miracles of nature by which they were surrounded; that were going on in the woods about them day by day. He taught the boys and girls what many farmers do not know, to distinguish the different kinds of woods by their bark; to distinguish the various kinds of plants, even before they had developed any of their foliage. He believed that by assembling the leaves of the trees and forming a little collection of that kind, something might be learned by farmers' boys themselves that they did not know.

To that man I feel that I owed the ability to pass that examination of Old Tar Heels Campbell. We smile at the peculiarities of that man, but those of you who have been discussing the subject of schools in the country will admit that that old man was twenty-five or thirty years ahead of his time. He appreciated and understood that the man or woman who should teach his boy or girl, should know something of the common phenomena of life. If you will follow it down in your district, as I have done in mine, you will often find boys and girls keeping school rather than teaching. The selection of teachers is often based on an exchange of courtesies among neighborly directors, rather than upon the fitness for the place. In order that Mary, in the one case might get enough money with which to buy a wedding outfit, and that John, in the other case, might get enough money to go off to college.

I have been reminded also, since I came here, of another man who was a very helpful teacher to me, a man now well advanced in age. My mind was called back to him by meeting an old friend whom I have not seen for a great many years until I came to your city for the first time. I refer to Prof. John J. Allison, superintendent of schools in this city, a schoolmate of mine with whom I have been able to renew acquaintance here. My meeting with him has reminded me of another man who was our teacher a good many years ago and the ideas that man had along the lines of education for boys and girls for practical business life. He maintained that life was too short to spend as much of it as some of our colleges do upon the knotty and dry points of ancient languages. He believed in physical exercise, but that it was not necessary for a student to spend three-fourths of his time practicing athletics and devoting himself to out-door sports. He expected most of his students, even though only 18 years of age, to come to him on their own resources, and to pay their own way at school in which they had to earn a position in the class by the work they were willing to do. They had to take their places in the class of chemistry and construct chemical apparatus for their own use. In physics, they had to make the different apparatus to demonstrate the different things they were to learn from that study. I remember well how we used to demonstrate the pressure of water. We put barrels on the ground and then suspended tubes from the third story window and burst those barrels by pouring water in the tubes. None of us could find a barrel strong enough to resist the pressure; demonstrating that there was something in this that was worth working out for ourselves. It was worth more than if we had expensive and complicated apparatus which we would scarcely be allowed to touch. This man was Alfred Holbrook, still teaching, happy and joyous at ninety years of age. Yes, I owe a debt of gratitude to those two men and I want to say to you that their methods seem to me in part, the solution of the topics you have been studying here; the working out and developing and bringing to the highest point of perfection that most valuable crop that is raised upon our farms, viz., the boys and girls. The results we are seeking will be found when we have, not merely unsophisticated boys and girls teaching those schools, but men and women of knowledge and experience, willing to go there and devote their time to that work. Now all this can be obtained where a consolidation of the country schools has been worked out. The day of the little country school house with five or ten or fifteen pupils and almost any kind of a teacher, is past. Illinois is taking a proud position along that line, and I am very glad to come almost from the state of Ohio, because I have one farm across the line, and I am proud to say that that farm is located in the district in which the first consolidated school in the state of Ohio was established. The old "Kid Wagon" still stands within a mile and a half of this farm, a more modern conveyance having taken the place of this old wagon of ten or fifteen years ago. These children are educated in the center of the township where they are transported at the public expense. By this consolidation ten schools with an average of thirteen children, were brought together and instead of 130, there came together almost immediately 230. Instead of ten teachers there were fewer teachers, but they were better qualified for the teaching of those children along the lines that would interest agricultural students—teachers able to comprehend the great phenomena of nature; able to illustrate them and bring them to the attention of the boys and girls, just as your own Professor Holden started and made his first experiments along the line of corn culture in the country schools by asking the boys to bring in some specimens of corn that they might be graded and examined.

And so we are demanding a wider range of practical knowledge on the part of the ordinary public school teacher and are bringing the boys into the public school and holding them there with topics that will keep them on the farm and making them feel that they do not need to go off to the city school, there to be identified with city life and thus be drawn away from life on the farm. But what has all this to do with the poultry business? Let us see.

Four weeks I was in Ithaca, N. Y., being called there to Cornell university to do some work along poultry lines and I heard one of the most learned professors spend an hour discussing embryonic life. It occurred to me then that at that other school where I spent some time with Professor Allison we had to prepare papers at regular intervals upon topics given us by our teachers and I remember that one time a topic was assigned to me that made me tremble—"Omne Vivium ex ova"—"All life originates in the egg." So far as I was able to comprehend it it might just as well have been —"Mene, mene, tekel upharsin"—"Thou art weighed in the balance and found wanting." But that little study made in working out that subject came back to me with wonderful vividness when that learned professor at Cornell brought before his audience eggs in the different stages of development. He had the eggs broken open, some with the shells removed, others with the little layer next to the shell also taken away and the next one with the layer immediately next to the white also taken off. He had them over the radiator so as to keep them warm and one of them had to be handled with the greatest care. It had been in the incubator just sixty hours. We could see the little blood vessels radiating out from a central point. Looking a little closer we could see the little pulsations and little heart beats of the future chick. Sixty hours development! Is there anything that will make us stand aghast at the wonders and handiwork of the great God more than this, when it will make us to see and study the first elements of the great thoughts of biology, zoology and the development of life? Whence came it? What will be the result?

Two weeks later I stood in a poultry show looking over the birds as they came in and were being placed in the different cages, some of them coming ten miles and some hundreds. One of the attendants came up and put a pair of birds into the same coop, one of them a pullet. She had scarcely been in the exhibition coop two minutes until she gave a little chuckle of satisfaction and began at the back of the coop, made herself a nest and deposited an egg —that was a strictly fresh egg. I was standing by a gentleman whom I shall call Mr. Johnson and I knew that he was fond of fresh eggs and ate them raw. I reached in the coop and took out the still warm, fresh egg, gave it to him telling him that he could eat it with the assurance that it was absolutely fresh. He took his knife and cracked the shell, removed it nicely and was about to raise it to his mouth to eat it raw, as some do, when he said: "Hold on! I don't want to eat that egg, it has a blood clot in it." He handed it to me. To him it was a blood clot. I put on my glasses and looked at it again; an egg not three minutes from the body of the mother. And there as I looked at it I saw the pulsations, the heart beats of the embryo chick corresponding to that which the professor at Cornell had showed us. Sixty hours development and I had seen the egg deposited in the nest! What did I see there? The chick of sixty hours development yet from the mother hen only five minutes! I trembled as I stood there with it in my hand. What is there in this little poultry business that we can develop out of this? What is there in it that we, the teachers of our country schools, should be able to bring to those students? A subject of which the average child is far too ignorant, something the boy has a right to know from his father and the girl from her mother; something that will equip them to pass out on life's journey better able to resist the temptations that come to them in life; of sex and development; of the social privileges that come to them in later life. All of them we saw in that little egg.

Shall I explain to you about that little egg? Starting from that little bunch from which the yolks are first formed, the yolk separating itself from that and dropping off and entering that oviduct, passing down and receiving the different layers of white, and then providing the female had been mated, receiving the life, i. e., fertilizing element; passing on down and at different stages receiving those layers which hold the whites together, and then receiving that other layer which encases it, and then the one next to the shell which lies between that and the outer layer, forming what is known as the air cells in the larger end of the egg. That little life germ received the life element from the mating a few days before, and from the time the life germ is received about twelve hours will naturally elapse until it is deposited in the nest. In other words, every fertile egg laid by a hen is not a strictly fresh egg. It is an egg that has passed for twelve hours in the process of incubation. Every egg that you eat of that kind is partially an incubated egg. And everyone putting fertilized eggs upon the market for commercial purposes runs just the risk that this man would have run had he put that egg upon the market with others. The people opening that egg would have said at once, "A blood clot!" It is dead as soon as the warmth is removed, but you are sending out partially hatched eggs. Is there something for thought in that?

As to this egg having received sixty hours incubation, I can simply give you my theory, and I can think of no other: The natural instinct of maternity of that pullet, shipped some three hundred miles to that show, under surroundings to which she was not accustomed, of a nervous, high bred temperament, in the removal in the wagon to the station, and passing through the different places of the express company, on the trains, etc., the excitement worked so upon her sense of maternal protection that she should give her chick (for bear in mind that every time you request a hen to deposit an egg in the nest for your breakfast, you are asking her to go through all the processes of natural reproduction), made her hold that egg for sixty hours. I can think of no other explanation for it.

But in that subject, embryology—that old topic given me to discuss so many years ago—has it not in it something of interest that the teachers and pupils of our school should study? Put with it the domestic science in the many phases so essential for them to know—subjects that bring them down to today; studies that make them feel that they are a part of the practical life of today, and that will interest them in the work for which they are being trained, and I leave with you the question—are there not many little things about poultry that we and our children at home and at school should study?

A Delegate—What is the remedy for roup?

Mr. Orr—The remedy for roup is largely of a preventative character. If you can prevent colds, or prevent draughts in your poultry houses and have clean surroundings, you are not liable to have it. In its earlier stages, if you can reach the points of difficulty with some kind of an antiseptic wash you may be able to relieve it. The best way is to inject something of that kind so that it gets into the nasal passages, and the only way of doing that successfully that I know of, is by immersing the head of the fowl in the remedial mixture and cause it to absorb the mixture itself, by drawing the application to the point of the disease. You can not get it there in any other way that I know of.

A Delegate—I would like to have you explain to us the matter of inbreeding.

Mr. Orr—That is too complicated for me to undertake to talk about with this audience now ready for dinner. The matter of line breeding in poultry is exactly the same as in horses and cattle. It is done for the purpose of emphasizing and developing the good points of some particular animal, by breeding him again to those he has already begotten. It is just exactly as every strain of Jersey cattle has been bred. The results are just as marked in poultry as in other lines. Is it a good practice? Yes, in some cases. But it is a two-edged sword with which people had better deal cautiously. If there is a strong point in a bird which you wish to develop, such strong point may be strengthened and developed by breeding the male first to his own daughter and second to his grand daughter. That has been done, the first generation getting 50 per cent of his own blood, and the second generation 75 per cent of his own blood. Twice I have carried that to the third generation, reducing that branch of the flock to one male and four females. We get the same results to be obtained in the breeding of Jersey cattle. The same thing has made the Holstein cattle what they are today.

All this can be had and more quickly, with results just as clearly discernible in poultry as in any other line of live stock. It developed prepotency or a power to reproduce the strong points of the parent in the offspring producing in its young the same characteristics.

Adjourned to 1:30 o'clock, p. m.

GENERAL SESSION, OPERA HOUSE, 1:30 P. M.,—FEBRUARY 23.

At the meeting of the Illinois State Farmers' Institute held at the Joliet opera house, Joliet, Ill., at 1:30 p. m., Thursday, Feb. 23, 1905, after the call to order by Chairman Wyman, the institute was favored by a reading by Miss Hanson.

Chairman Wyman then called for the report of the committee on resolutions. The report was read by Director James Frake, who moved the adoption of the seven resolutions given below. After the reading of each resolution, Mr. Frake's motion to adopt was seconded, put by the chairman, and carried.

WHEREAS, An essential toward home making is furnishing nutritious food to the family, and

WHEREAS, The skill to make good bread and the knowledge of the composition of the same is necessary for the furnishing of such food, and

WHEREAS, It should be the aim to train the girls of Illinois in this essential toward home making, be it therefore,

Resolved, That every county farmers' institute encourage the girls in the science of bread making by offering suitable premiums for making bread.

WHEREAS, The teachers of Illinois are being called upon to give instruction in agricultural science and in domestic economy, and

WHEREAS, Many teachers have had no opportunity to prepare themselves for this important work, and

WHEREAS, There are thousands of men and women, young and old, who can not, from the very nature of things, become resident students of the college of agriculture, and who yet earnestly desire such scientific instruction as will enable them better to avail themselves of the results of the magnificent work being done at our State and National experiment stations, and

WHEREAS, The Illinois Farmers' Institute did, in convention assembled in Decatur, in February, 1904, express its earnest desire that a school of correspondence in connection with our college of agriculture at Urbana, should be established and operated in the interest of these classes and of the people as a whole, and

WHEREAS, Provision is made for establishing and operating such school in a bill for an act to provide for the general expenses of the University of Illinois, of which the agricultural college is a part, and

WHEREAS, Said bill has already been introduced into the Forty-fourth General Assembly, therefore

Resolved, That we approve this action and that we hereby instruct our legislative committee to use all honorable means to secure the passage of this bill without the elimination of that part relative to a school of correspondence.

WHEREAS, The country child is entitled to as good educational privileges as is the city child, and

WHEREAS, Any adequate system of country schools necessitates a territorial unit so large as to make the transportation of children inevitable, therefore, be it

Resolved, By the Illinois Farmers' Institute in convention assembled that we most earnestly urge the passage of the bill permitting any community that so desires, not only to establish for itself adequate schools, but to carry the children to these schools at public expense, and be it further

Resolved, That we are impelled to this action by the urgency of the situation and because no other course is open that will meet the educational demands that are upon the agricultural people, and be it further

Resolved, That the secretary be instructed to furnish a copy of these resolutions to each member of the General Assemby now in session at Springfield.

WHEREAS, There has been introduced in the General Assembly now in session, a bill to create a Library Extension Board, and

WHEREAS, The directors of the Illinois Farmers' Institute at their last meeting, held January 24, 1905, voted unanimously to turn over to said board, when organized, all of its circulating libraries, now, therefore, be it

Resolved, that the Illinois Farmers' Institute, in convention assembled, approve said action, and does hereby instruct its legislative committee to use all honorable means to secure the passage of the said bill creating the Library Extension Board,

WHEREAS, The matter of interesting young people in the farmers' institutes—of actually getting them into the institute and instructing them there —is one of the very greatest institute issues today, and is becoming widely recognized as such throughout the United States and Canada, and

WHEREAS, It is desirable that the young people's institute movement be made a distinctly educational one and result in getting the boy or girl to actually study practical facts and principles in agriculture and come in contact with the sources of such information, to get a foundation of knowledge and inspiration that may reasonably be expected to lead on to an intelligent preparation for the successful practice of some branch of agriculture, and for continuous touch with the experiment station and study of the results of agricultural investigation, and

WHEREAS, These objects and even attendance at the institute sessions are not assured by the ordinary corn exhibit contest, and

WHEREAS, Director A. P. Grout in Scott County Farmers' Institute has the past year given a new and striking example of how to really move the young people in the desired direction—getting 19 boys to study corn judging under an expert corn judge, to judge corn themselves at the institute, to attend all day sessions of the institute; and as a premium for the best work done in corn judging one boy had his entire expenses paid at the Corn Growers' convention in January at the University of Illinois, where he had the opportunity of earning a certificate as an expert corn judge, and

WHEREAS, Every attendant circumstance and result of this project have proven its peculiar fitness for accomplishing the very objects desired, far in advance of any previous method; therefore, be it

Resolved, That the Illinois Farmers' Institute recognizes in the Grout corn judging contest one of the most practical and valuable institute developments of the year, commends its several educational features as of the utmost importance, and recommends that similar educational contests be established in as many counties as possible the coming institute season. The cost of such a premium is merely nominal, and one, two or three boys can easily be sent to the college of agriculture from almost any county for the two weeks of this corn judging school.

WHEREAS, The improvement of the wagon roads of the State is of importance to all the people of the State, and

WHEREAS, The Nation and State have spent vast sums of money in the improvement of our waterways, which are themselves dependent upon the wagon roads over which traffic must generally pass before reaching the waterways; therefore, *Resolved*, That we favor a system of National and State aid for the improvement of our wagon roads similar to the system so long practiced in aid of waterways, and

Resolved, That we favor the most searching inquiries upon the part of the State of Illinois as to the methods of construction best adapted to conditions in Illinois, and we favor the scientific testing of native materials that may be best utilized for surfacing wagon roads; and be it further

Resolved, That in view of the great importance of the subject and the necessity for practical demonstration as well as experiment, we feel that Illinois can afford to do as much for this cause as is being done by some of the smallest states of the Union; and we favor a liberal appropriation by the General Assembly to be used in practical demonstration and experimental work in order that the people of the State may have reliable information before embarking in an expensive system of wagon road construction.

Resolved, That we hereby extend to the local organization for promoting the meeting of the Illinois Farmers' Institute, especially to Mr. E. L. Wilson, Mr. Robert Eaton and Mrs. Chas. Francis, of said organization, to the various committees assisting therein, to the citizens of Will county, to the entire press of the city of Joliet, and to every person who has taken part in the various programs of this, the most successful "Round-Up Meeting," ever held by the Illinois Farmers' Institute, our sincere appreciation and thanks.

Respectfully submitted,
JAMES FRAKE,
H. G. EASTERLY,
E. W. BURROUGHS.
Committee on Resolutions.

The Chairman—I have the pleasure, now, of introducing to you Dr. Hopkins, who will occupy the balance of the time till 4:00 o'clock, talking to you upon the subject of Illinois soil, one of the most interesting topics of the State of Illinois. [Applause.]

DR. C. G. HOPKINS.

FACTORS IN CROP PRODUCTION WITH SPECIAL REFERENCE TO PERMANENT AGRICULTURE IN ILLINOIS.

In order to emphasize the importance of producing and maintaining large crop yields on Illinois lands, I ask you to consider the data presented in table 1, in which I have tried to illustrate in some detail the method of measuring land values by crop yields. You will understand, of course, that these data, at the best, represent only approximately average conditions. Thus the price of corn is placed at 35 cents a bushel, to represent approximately the average price over a series of years. The price of corn has been known to vary from less than 20 to more than 60 cents a bushel, and although 35 cents may be the average for the past ten years, it may not be the average for the next ten years. The expense of taking hay from the swath and delivering it in bales on the local market is placed at $2.50 a ton. This may fairly represent the expense in one section of the State where the cost of baling is $1.25 a ton and where labor is obtained at a corresponding price, but it would not be sufficient where the baling costs $2.00 a ton, with other expenses in proportion.

Remember I do not even suggest that you accept these data for your conditions, but only that you consider the principle of measuring land values by crop yields, on the basis of selling the crops at the local markets. Then if you have any further interest in the matter, I suggest that you change these data to fit your own average local conditions and then recalculate the land values, not only on the basis of selling the crops on the market, but also on the basis of feeding part or all of the crops grown and selling the animal products thus produced. In some sections or in some seasons, or under some systems of farming, there are several side products, or by-products, which might properly be considered, such, for example, as corn stover, straw and clover seed.

Value of Land Measured by Crop Yields,

AN ACRE OF CORN AT 35 CENTS A BUSHEL.

CROP YIELD—BUSHELS OR TONS.	Gross value of crop.	ANNUAL EXPENSE.					Net value of crop.	Net value of land.
		For plant food.	To grow crops.	Harvest and market.	Taxes on land.	Total expense.		
20	$ 7 00	$0 80	$4 00	$1 00	$0 11	$ 5 91	$ 1 09	$ 21 81
40	14 00	1 60	4 00	2 00	58	8 13	5 82	116 36
60	21 00	2 40	4 00	3 00	1 05	10 45	10 45	210 91
80	28 00	3 20	4 00	4 00	1 53	12 73	15 27	305 45
100	35 00	4 00	4 00	5 00	2 00	15 00	20 00	400 00
20	7 00	80	6 00	1 00	00	7 80	80	16 00
40	14 00	1 60	6 00	2 00	40	10 00	4 00	80 00
60	21 00	2 40	6 00	3 00	87	12 27	8 73	174 55
80	28 00	3 20	6 00	4 00	1 35	14 55	13 45	269 09
100	35 00	4 00	6 00	5 00	1 82	16 82	18 18	363 64

AN ACRE OF WHEAT AT 70 CENTS A BUSHEL.

10	$ 7 00	$0 50	$3 00	$1 00	$0 23	$ 4 73	$ 2 27	$ 45 45
20	14 00	1 00	3 00	2 00	73	6 73	7 27	145 45
30	21 00	1 50	3 00	3 00	1 23	8 73	12 27	245 45
40	28 00	2 00	3 00	4 00	1 73	10 73	17 27	345 45
50	35 00	2 50	3 00	5 00	2 23	12 73	22 27	445 45

AN ACRE OF OATS AT 25 CENTS A BUSHEL.

20	$ 5 00	$0 50	$3 00	$1 00	$0 04	$ 4 54	$ 0 46	$ 9 09
40	10 00	1 00	3 00	2 00	36	6 36	3 64	72 73
60	15 00	1 50	3 60	3 00	68	8 18	6 82	136 36
80	20 00	2 00	3 00	4 00	1 00	10 00	10 00	200 00
100	25 00	2 50	3 00	5 00	1 32	11 82	13 18	263 64

Value of Land Measured by Crop Yields—Concluded.

AN ACRE OF TIMOTHY HAY AT $8.00 A TON.

CROP YIELD—BUSHELS OR TONS.	Gross value of crop.	ANNUAL EXPENSE.					Net value of crop.	Net value of land.
		For plant food.	To grow crops.	Harvest and market.	Taxes on land.	Total expense.		
½..............	$ 4 00	$1 00	$1 00	$1 25	$0 07	$ 3 32	$0 68	$ 13 64
1..............	8 00	2 00	1 00	2 50	23	5 73	2 27	45 45
1½..............	12 00	3 00	1 00	3 75	40	8 15	3 85	79 09
2..............	16 00	4 00	1 00	5 00	55	10 55	5 45	109 09
2½..............	20 00	5 00	1 00	6 25	70	12 95	7 05	140 91

AN ACRE OF CLOVER AT $6.00 A TON.

CROP YIELD—BUSHELS OR TONS.	Gross value of crop.	For plant food.	To grow crops.	Harvest and market.	Taxes on land.	Total expense.	Net value of crop.	Net value of land.
½..............	$ 3 00	$1 10	$1 00	$1 25	$0 00	$ 3 35	$0 35	$ 7 00
1..............	6 00	*2 20	1 00	2 50	03	6 73	27	5 45
1½..............	9 00	3 30	1 00	3 75	09	8 14	86	17 27
2..............	12 00	4 40	1 00	5 00	15	10 55	1 45	29 09
2½..............	15 00	5 50	1 00	6 25	20	12 95	2 05	40 91

* This would be $2.40 for the phosphorus and potassium alone, but 20 cents credit is given for the nitrogen stored in the roots and stubble for each ton of clover hay produced.

In the computations I have made, I have tried to avoid using data which would exaggerate the land values. It must be understood that the values given are for the year during which the particular crop is grown. The average value would depend upon the rotation of crops and would be the average of the different values found in the different years of the rotation.

For plant food, I have allowed 1 cent a pound for nitrogen (expecting it to be furnished by legumes and farm manure,) 12 cents a pound for phosphorus and 6 cents a pound for potassium. (At these prices phosphorus can be bought in steamed bone meal and potassium in potassium chlorid.) For taxes, I have allowed ½ per cent on the value of the land.

By referring to the table, it will be seen that twenty bushels of corn at 35 cents a bushel gives a gross return of $7.00 an acre. Deducting from this $5.91 the total annual expense, including 80 cents for plant food removed in the crop, $4.00 for growing the crop (plowing, planting, cultivating, etc.), $1.00 (5 cents a bushel) for harvesting and marketing, and 11 cents for taxes, we have left $1.09 as the net value of the crop. This is equal to 5 per cent interest per annum on a valuation of $28.81 per acre.

With forty bushels of corn per acre, the value of the land becomes $116.36. In other words, by doubling the crop yield, we multiply the land value more than five times. With sixty bushels of corn per acre, the land becomes worth $210.91; with eighty bushels, $305.45; and, if we could raise 100 bushels of corn per acre, we could pay the annual expense of $4.00 for plant food, $4.00 for raising the crop, $5.00 for harvesting and marketing, and $2.00 an acre for taxes, and still have left $20.00 an acre, as the net value of the crop. This would pay 5 per cent interest on exactly $400.00, which would represent the value of the land for that year.

If land costs $100.00 an acre, the interest and taxes would be $5.50. If we raise forty bushels of corn per acre, the profit from the business would be 90 cents an acre; whereas if we raise sixty bushels per acre, the profit for the year becomes $6.00 an acre. In other words, by increasing the yield only 50 per cent, we have increased the profit more than 600 per cent.

If we increase the cost of growing the crop from $4.00 to $6.00 an acre, the value of the land, if only twenty bushels of corn are produced, is $16.00 below zero, although with forty bushels the land becomes worth $80.00 an acre and rises to $363.64 with a 100-bushel crop.

By similar methods of computation we find that with wheat at 70 cents a bushel, crops ranging from ten to fifty bushels produce land values ranging from $45.45 to $445.45 an acre; and that with oats at 25 cents a bushel, crops ranging from twenty to 100 bushels per acre produce land values from $9.09 to $263.64.

It is perhaps worthy of special consideration that with timothy hay worth $8.00 a ton, the land value rise to only $140.91 with two and one-half tons of baled hay from an acre; but still more significant is the fact that if we are to sell clover hay at $6.00 a ton, two and one-half tons of baled hay per acre would produce a land value of only $40.91, notwithstanding that the clover is credited with the nitrogen which it adds to the soil.

These data certainly emphasize the fact that there is great loss in selling hay at $6.00 or $8.00 a ton if we are to maintain the fertility of the land.

On land worth $150.00 an acre there is an actual loss of $1.00 a year in selling timothy hay at $10.00 a ton if we are to maintain the fertility of the soil and raise one and one-half tons to the acre. If we can afford to do this, it is because we have in our soils such an abundant stock of the element potassium that we are willing to sell it for 3 cents a pound when it is worth 6 cents in the Chicago markets in the cheapest commercial form.

ESSENTIAL FACTORS IN CROP PRODUCTION.

While I shall dwell mainly upon the subject of plant food in this paper, no one should understand therefrom that I do not consider of great importance the other five essential factors of crop production; namely, the heat, light, moisture, the physical condition of the soil and the seed; indeed these six factors are of equal importance because they are all absolutely essential to growing crops.

It is certainly important that we improve our seed corn, and our seed oats, and seed wheat and all other seed, so far as practicable and profitable.

And let us improve the home of the plant—by better drainage, by increasing and maintaining humus in the soil and by better plowing and more frequent and thorough cultivation. This is an exceedingly important matter in crop production, for by it we may to some extent control both heat and moisture. Drainage not only removes the surplus water from a "water-logged" soil, making plant growth possible, but decreases the amount of water to be evaporated from the surface and permits the sun's heat, which would be required to evaporate that water, to be utilized in warming the soil; it also allows the air to enter the soil, increasing the activity of soil organisms at greater depths, encouraging the plant roots to penetrate the soil more deeply, thus adding to the organic matter of the subsoil and increasing its porosity and giving the soil greater power to absorb and retain moisture and resist drouth. And let us bear in mind that this applies not only to the flat level lands but also to the rolling lands—and sometimes with even greater force; for thorough tile-drainage is one of the best means of reducing the surface washing of rolling lands. We may also conserve the moisture to a considerable extent by maintaining dust mulches produced by proper cultivation; and, by increasing the organic matter in the soil we are able to increase the temperature of the soil, for the dark color of a soil is largely due to its organic matter content and dark soils are warmer than light-colored ones. Recent investigations by Professor Mosier at the Illinois Station have shown that the temperature of a light-colored soil was raised five or six degrees when it was covered with a thin layer of dark soil and this difference was maintained from 10:00 or 11:00 o'clock in the morning till nearly sundown. This is a point of some importance during the early part of the season. Actual tests by Professor Mosier showed that seeds germinate more quickly and the young plants grow more rapidly in the darker soils.

Of the six essential factors, light is the only one over which we have almost no control, but fortunately it is also the factor which rarely, if ever, limits the yield of crops.

ELEMENTS OF PLANT FOOD.

But I am to speak with special reference to the subject of plant food which I believe is truly the least understood and the most neglected of all the factors essential to crop production.

I scarcely need to remind you that there are ten essential elements of plant food. Of these, carbon is the only one obtained directly from the air by most agricultural plants. The fixation of carbon occurs in the leaves, the carbon dioxid of the air reacting with the elements hydrogen and oxygen from the water (which is absorbed by the roots and carried to the leaves), forming organic compounds which finally condense to sugar, starch, cellulose, or wood fiber and other carbohydrates. Many who are familiar with the fixation of atmospheric nitrogen by means of nitrogen-gathering bacteria living in tubercles on the roots of legume plants are not aware of the fact that more than 90 per cent of the total dry weight of most agricultural plants results from the fixation of carbon and the consequent formation of carbohydrates and other organic bodies. While this very large percentage of the plant consists of the three plant food elements, carbon, hydrogen and oxygen, these three elements are no more essential to the life of the plant than the seven other elements of fertility, as calcium, magnesium, iron and sulphur, all of which are present in most soils in quantities far beyond the needs of crops for ages to come; or as nitrogen, phosphorus and potassium, of which one or more may be so deficient in a soil as to limit the yield of the crop.

It is to the consideration of these three well known elements of plant food, nitrogen, phosphorus, and potassium, which are sometimes called the "golden tripod" of agriculture, that we may well devote more of our time.

CROP YIELD IN SOIL EXPERIMENTS.

In order to emphasize the possible tremendous importance of each of these elements of soil fertility, I beg to ask your attention to Table 2, which gives some of the most striking yet absolutely truthful results which we have thus far obtained in our investigation of Illinois soils.

From the information obtainable from American and European research, it is estimated that a normal fertile soil of ordinary physical composition should contain the amounts of plant food shown in column 1, as commonly determined; namely, about 5800 pounds of nitrogen, 2000 pounds of phosphorous, and 5300 pounds of potassium per acre in the surface soil to a depth of seven inches, which is considered a good depth for plowing. Column 2 shows the plant food contained in the richest soil of large area in Illinois, commonly called "gumbo," while column 3 represents the most common soil of the Corn Belt in Illinois, this soil being a brown silt loam. In this column are also given results obtained from two different soil experiment fields located on this type of soil, the first located near Sibley, in Ford county, and the second near Bloomington, in McLean county. Nitrogen and potassium applied to this soil either singly or together have produced injury rather than benefit to the corn crop; while phosphorus, applied in steamed bone meal at a cost equal to the present value of six bushels of corn, produced eight bushels gain on the one field and thirteen on the other. After nitrogen had been applied (which can be furnished by clover in rotations), the gains due to phosphorus are fifteen bushels on the Sibley field and eighteen bushels on the Bloomington field. More phosphorus was applied than was removed by the largest crop.

TABLE 2—PLANT FOOD IN SOME ILLINOIS SURFACE SOILS.

Pounds per Acre.

PLANT FOOD ELEMENTS OF MONEY VALUE.	Normal fertile soil U. S. & Ger. ave.	Black clay loam Wis. Gla.	Brown silt loam Wis. Gla.	Red silt loam unglaciated.	Gray silt loam Lower Ill. Gla.	Peaty swamp soil* (drained land.)
Nitrogen	5,800	7,980	5,320	1,000	3,180	12,300
Phosphorous	2,000	1,920	1,020	1,000	600	1,780
Potassium	5,300	9,440	10,040	5,600	5,220	1,680

CROP YIELDS IN SOIL EXPERIMENTS.

PLANT FOOD APPLIED.	Corn bu.		Wheat grams.	Wheat bu.	Corn bu.
None	54	60	3	7	....
Nitrogen	54	60	26	11	....
Phosphorus	62	73	3	25	....
Potassium	60	56	3	16	45
Nitrogen, phosphorus	69	78	34	33	....
Nitrogen, potassium	51	59	33	20	59
Phosphorus, potassium	61	75	2	28	47
Nitrogen, phosphorus, potassium	64	81	34	33	59

To the old worn unglaciated hill soil of southern Illinois (red silt loam, the principal type in seven counties), whose chemical composition shows it to be markedly deficient in nitrogen, we added both phosphorus and potassium and obtained practically the same yield as where no plant food was applied, but when nitrogen was added the yield of wheat in pot cultures was increased from only three grams to from twenty-six to thirty-four grams per pot.

To the principal type of soil in the Lower Illinois Glaciation (covering more than twenty counties), whose analysis shows that its phosphorus content is less than one-third of a normal fertile soil, phosphorus was added and the yield of wheat was increased, from seven to twenty-five bushels per acre. (The marked effect of potassium on this soil when used alone or with nitrogen only, whereby the yield of wheat was increased nine bushels per acre in each case, was probably produced, in part at least, by the corrosive or destructive action of the soluble potassium salt. Even common salt (and sodium chlorid) and land plaster (calcium sulphate) produce similar effects on some soils, especially with wheat. Possibly this caustic action tends to liberate phosphorus from the soil. This effect is also indicated where potassium was added with nitrogen on the unglaciated hill land).

To the peaty swamp soil, representing some hundred thousand acres in north central Illinois, whose composition shows that it contains less than one-third as much potassium as a normal fertile soil and only one-sixth as much potassium as the best soils in the corn belt, we added both nitrogen and phosphorus and obtained practically the same crop as where no plant food was added, the total yield per acre amounting to less than a ton of corn fodder with practically no ear corn; and, yet where we applied potassium to that soil we obtained about two tons of corn stover and forty-five to fifty-nine bushels per acre of good sound corn. (Applied nitrogen produced an appreciable effect only because of insufficient nitrification of the soil nitrogen, due to imperfect drainage.)

Most of these results were obtained after two or three years' treatment, and in all cases, abundance of the deficient element was applied to meet the needs of large crops.

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*Not only low in potassium, but high in magnesium-carbonate.

MAINTAINING SOIL FERTILITY.

One of the problems which probably is, and which surely ought to be, uppermost in our minds is how to restore the fertility of our poorer soils and how to profitably and permanently maintain all our lands in a state of high productive capacity.

You will pardon me if I emphasize the fact that the Illinois standard for the investigation of Illinois soils is set to bring about a system of agriculture in Illinois which shall at least permanently maintain the high crop yields of our best soils and which shall increase the fertility of our poorer soils their maximum profitable productive capacity.

But to grow large crops requires large quantities of these valuable elements of plant food, and this brings us to the subject of the "Circulation of Plant Food." This I believe is the most important process connected with any possible system of permanent agriculture. The farmer of greatest temporary success is as a rule the farmer who takes the largest amounts of plant food from the soil; but the system of farming of greatest permanent success must be a system which will not only take large amounts of plant food from the soil, but which brings about such a circulation of plant food that so far as necessary equivalent amounts are returned, again to be used by growing crops, and again to be returned.

HISTORIC SYSTEMS OF LAND RUIN.

The almost universal practice of the civilized world up to date has been to ruin land and then cry, "Westward Ho!" and he who undertakes to say that the rich soils of the great central states can never be reduced in fertility knows not whereof he speaks.

What has been the system? And what is the common practice today? First, beginning with virgin soil, we crop continuously with corn and small grains till the practice becomes unprofitable. Second, when these crop yields become much reduced, we introduce clover into the rotation and thus maintain, to some extent at least, the nitrogen. But the fixation of nitrogen is not the only function of clover, nor indeed its most effective function on many soils. Clover is a gross feeder on phosphorus. Considerable quantities of the elements taken from the soil and subsoil by the deep rooting biennial clover plant remain in the roots and stubble and, as these residues decompose, the products of fermentation and decay liberate still other quantities of phosphorus from the soil itself, thus furnishing a good supply of available phosphorus to succeeding crops of corn or other grain. (Potassium may be effected in a similar way.) On soils where this is the principal effect of growing clover in rotation, applications of phosphorus produce about the same increase in crop yields as are produced by the use of clover; whereas, applications of nitrogen itself, even in the best forms, produce little or no increase in the crop. Furthermore, on such soils, about the same effects are produced by the use of non-leguminous green manures, such as rye, buckwheat, or rape, as are produced by clover or by applications of phosphorus.

Usually this process continues until the clover system fails, until the clover crop is unable to obtain sufficient phosphorus for its own growth.

Landplaster and caustic lime are next brought into use to force the soil to give up plant food which could not otherwise be obtained by crops. This system is effective but short lived, for after a score of years the soil commonly refuses to yield up the required quantities of its remaining stock of fertility even under the destructive action of these powerful stimulants. It is this use of lime that is referred to by the well known German proverb which says; "Lime may make the fathers rich, but it makes the children poor."

Then comes the common commercial fertilizer system, in which we apply to the soil not sufficient plant food to grow good crops and maintain the productive capacity of the soil, but only enough to supplement that which can still be forced from the land. The most common application is 200 pounds per acre of so called 2-8-2 goods applied once or twice in a four-year or five-year rotation. This means 2 per cent of ammonia, 8 per cent of so-called phosphoric acid, and 2 per cent of potash. A 200-pound application of such a "complete" commercial fertilizer would supply four pounds of ammonia, sixteen pounds of so-called phosphoric acid, four pounds of potash; or in the language of Illinois, about three and one-half pounds of actual nitrogen, seven pounds of actual phosphorus, and three and one-half pounds of actual potassium, whereas a 100-bushel crop of corn would remove from the soil in one season about 148 pounds of nitrogen, twenty-three pounds of phosphorus and seventy-one pounds of potassium; or forty times as much nitrogen, three times as much phosphorus and twenty times as much potassium as is commonly applied for two or three year's crops. Sometimes acid phosphate alone is used and this is certainly less absurd than to continue to buy potassium when it is not needed, and to pay 15 cents a pound for nitrogen when it can be obtained from the air at a cost not to exceed 1 cent a pound or at no cost whatever if the legume crops and catch crop are properly fed or pastured.

But even where acid phosphate alone is used the applications are usually too small to supply the needs of maximum crops and maintain the supply of phosphorus in the soil. The common practice is to remove all that can be extracted from the soil even by the aid of the 60 per cent of manufactured landplaster, contained in the acid phosphate, and then depend upon the added phosphorus to make up the balance required by the crop. Even in the rotation experiments at the Ohio station, where a system better than commonly followed has been practiced, the total phosphorus applied in acid phosphate during a five-year rotation is less than is contained in a single 100 bushel crop of corn.

Most farmers use more or less farm manure, and this is well, for it helps to maintain the supply of nitrogen and potassium, even though it does not return much phosphorus to the land. It should be remembered that about three-fourths of the potassium in a crop of corn. wheat or oats is contained in the stalks or straw, while only one-fourth is contained in the grain; also that when the crop is fed to animals, practically all of the potassium is returned to the soil in the solid and liquid manure; whereas, about three-fourths of the phosphorus in the crop is contained in the grain, and even if the grain is all fed, a considerable part of the phosphorus remains in the bones of the animals and is thus sold from the farm.

THE SUPPLY OF PHOSPHORUS IN ILLINOIS SOILS.

Please bear in mind that the average soil of the corn belt in Illinois contains about 1,000 pounds of acid-soluble phosphorus in the plowed soil of an acre, to a depth of seven inches; while the total phosphorus in the same soil, including both acid-soluble and insoluble, is only about 1,500 pounds. A 100 bushel crop of corn contains seventeen pounds of phosphorus in the grain alone. Thus the acid-soluble phosphorus is sufficient for fifty-nine such crops, if only the grain is removed from the land; while the total supply of phosphorus would be sufficient for only eighty-eight such crops. The subsoil is more deficient than the face, in phosphorus. These figures are not given as tentative; they are based upon sufficient accurate analytical data from large numbers of representative soil samples, collected with the greatest possible care from all of the great soil areas in the State to justify us in saying that they are, in round numbers, exact and final. The chemical analyses have not been made by one chemist alone, but seven different soil analysts, than whom there are today, none more experienced or more accurate, have had part in this analytical work. L. H. Smith, J. H. Pettit, E. M. East, W. F. Pate, I. O. Schaub, C. A. Schroeder and Andrew Ystgard are these analysts. They represent the training of Johns Hopkins and Cornell Universities, of the well known chemical department of the North Carolina Agricultural College, of the scientific schools of Norway, and of the chemical department of the University of Illinois, and the experience and practice received in the Illinois experiment station.

In addition to the chemical analyses there are the university soil experiment fields in all parts of the State, all in charge of our superintendent, J. E. Readhimer, to whose faithfulness and accuracy twenty progressive farmers can testify—farmers upon whose lands these soil experiment fields are located and to whom great credit is due for their watchful care of the fields, for their assistance to the experiment station, and for the valuable service which they thus render to the State.

Hundreds of farmers are also watching these experiment fields as the work goes on from year to year.

Furthermore, your own committee upon soil investigations, frequently accompanied by Director Davenport and by agricultural editors, annually visits nearly all of these soil experiment fields, giving of their own time that they may watch the progress of the investigations and inspect the actual work in the field, not only on the soil experiment fields, but also on the soil survey, which is being prosecuted with a degree of accuracy and industry which commands the respect of visitors who have the time and energy to follow such men as J. G. Mosier, Clifford Willis, R. C. Lloyd and E. L. Worthen, through the fields and over the hedges, criss-cross, and forward and back, from 7:00 in the morning till 6:00 at night, everywhere examining the soil to a depth of forty inches or more.

The fact was clearly determined and definitely established more than two years ago that the supply of phosphorus in most Illinois soils is limited; indeed, most farmers who read the bulletins from the Experiment Station or any of the leading agricultural papers of Illinois, or who attend farmers' institutes, are not only well informed as to the need of phosphorus in Illinois soils, but many of them are already using on their own farms liberal amounts of phosphorus in connection with legumes and farm manure.

THE STATE'S INTEREST IN SOIL INVESTIGATIONS.

Gentlemen of the Illinois Farmers' Institute, the thing of first importance to Illinois is not that we have grown larger crops with greater profits. The fact of greatest moment to Illinois is not that the Experiment Station has grown seventy-three bushels of corn per acre on the peaty swamp land of Kankakee county by the addition of potassium, while only four bushels were grown without potassium on similar adjoining land. The work of highest interest to Illinois is not that we have increased the yield of corn thirteen bushels per acre on the most valuable land in McLean county by the addition of phosphorus and that half of this increase was net profit. The result of chief significance to Illinois is not that we have increased the yield of wheat in Washington county by the addition of phosphorus from nine to thirty-one bushels and, on a duplicate field, from eleven to thirty-three bushels per acre, the thirty-three bushels being worth 15 cents more per bushel than the eleven bushels. The accomplishment of maximum value to Illinois is not that we have produced two tons to the acre of red clover hay by means of limestone and phosphorus and proper inoculation on the ordinary prairie soils of Effingham county, where red clover was never grown before. No, not these. But the thing of first importance, the fact of greatest moment, the work of highest interest, the result of chief significance, the accomplishment of maximum value, and the only achievement of permanent benefit to Illinois is that the soils which are producing these increased crop yields are being made richer and not poorer.

When we apply phosphorus sufficient for a 100-bushel crop of corn and thereby increase the yield from sixty to seventy-three bushels, it is of only temporary interest to the farmer that one-half of this thirteen-bushel increase is net profit, but the fact which interests the State is that the field which produced the seventy-three bushels is still richer than it was by an amount of phosphorus equal to twenty-seven bushels of corn, while the untreated field is poorer by the phosphorus removed in sixty bushels.

Most Illinois soils are still rich and highly productive. The average yield of corn in the Corn Belt is I think more than forty bushels per acre, and the average yield for the entire State is thirty-three bushels. Much of our richest land has been drained out and put under cultivation during the past twenty years. We are still growing large crops and there is no need for any sensation, but there is need for sense, and the time is now here when we should stop depleting our soils of plant food elements which already limit our crop yields and begin returning in liberal quantities the plant food needed to grow still larger crops. If we fail to do this while we are raising forty to sixty bushels of corn per acre, how can we hope to be able to do it if our yields shall become reduced to twenty or thirty bushels? But if we can adopt a permanent system and by so doing make our farming more profitable in building up the soil than it would be in running it down, then how much greater is our sin, if in our prosperity we neglect our opportunity, and our duty and afterward turn over to our children an impoverished soil!

FORMS OF PHOSPHORUS FOR ILLINOIS SOILS.

The annual corn crop of Illinois is more than 300,000,000 bushels. More than 50,000,000 pounds of the element phosphorus is removed from the soil in this crop, even though all of the stalks are left on the land. The phosphorus in all other crops will surely exceed the amount returned in manure; so that there are at least 50,000,000 pounds of phosphorus annually removed from Illinois soils. At 12 cents a pound for phosphorus, the present price in acid phosphate, this would cost $6,000,000 annually. At 3 cents a pound for phosphorus, the present price in raw rock phosphate, it would cost Illinois $1,500,000 annually to replace this amount of phosphorus, and this is the lowest priced form of phosphorus in the world today. I do not know which form of phosphorus will prove the most economical and the most profitable to use under the varying conditions and the different lengths of time involved in its use; but I do know this; that one of the greatest, if not the greatest problem which is to confront the people of Illinois is the phosphorus problem; and I believe that the time is now here when every Illinois land owner should adopt a system of farming which shall tend to increase rather than diminish the supply of phosphorus in his soil. I say landowner because I have no right to expect tenant farmers to pay out their money to build up my soil. If the land owner furnishes phosphorus, or lime, or other materials at the nearest railway station, then the man who farms the land should haul such materials to the farm and properly apply them to the soil.

I firmly believe that the supply of phosphorus in Illinois soils can be profitably maintained by the use of sufficiently large quantities of acid phosphate; and if the continued use of acid phosphate finally produces such acid conditions in the soil as to prevent the growth of clover as appears to have been a common occurence where it has long been used, then the acidity can be corrected from time to time by applications of some form of lime.

At present prices we can profitably substitute for acid phosphate steamed bone meal, which is known to be a satisfactory form of phosphorus, and thus avoid the possible injurious effect of acid phosphate, but this suggestion could not be adopted by any large proportion of the farmers of this country because of the limited supply of bone meal.

The only very extensive supply of phosphorus is the natural rock phosphate, from which acid phosphate is made by mixing a ton of rock phosphate, with about a ton of sulfuric acid (oil of vitriol), the resulting acid phosphate being sold for about $15.00 a ton, or $30.00 for the two tons of material which contain no more phosphorus than the original one ton of raw rock phosphate, which we get for about $8.00 delivered in Illinois.

As to the value of non-acidulated, finely ground natural rock phosphate, I consider this as a material which gives great promise of extensive use in the economic and profitable improvement of poor soils and in the maintenance of large crop yields on good soils, especially in the states throughout the great central west. It should be distinctly understood, however, that repeated experiments have shown that this material gives practically no immediate returns if used in the absence of decaying organic matter. On the other hand, when used in intimate connection with liberal amounts of farm manure or green manures or both, we have conclusive evidence that it is one of the most economic and profitable froms of phosphorus, especially where the crop returns for a series of years are to be taken into account.

In exact pot-culture experiments carried on under controlled conditions at the University of Illinois, ground rock phosphate used in connection with clover and manure has produced some marked results. Extensive field experiments in operation in our State and in other states also point in the same direction, although the Illinois experiments have not been carried on for a sufficient length of time to justify final conclusions. In 1904, on the university fields at Urbana where we had applied rock phosphate without manure, it produced 4.1 bushels increase in the corn crop, as an average of sixteen separate tests. Where we had applied both rock phosphate and farm manure, the rock phosphate produced an increase of 8.1 bushels of corn per acre, as compared with the manure alone, this also being the average of sixteen separate tests. The rock phosphate was applied in amounts from 1,000 to 2,000 pounds per acre and 1,000 pounds per acre of ground limestone was applied with it for the special benefit of legume crops which are to follow in the rotation. The eight bushels increase would more than pay for one-fourth the expense for both phosphate and limestone, even with the 2,000 pounds of phosphate applied every four years. In both cases the results were more marked than we had expected.

I have received only two letters from Illinois farmers giving the results from their trials with rock phosphate in 1904. One of these is from Mr. James A. Dewey, a graduate of the Illinois Agricultural College, who is operating a farm in Vermilion county, and the other from a gentleman with whom I am not acquainted, Mr. J. O. Winship, of Putnam county. I feel sure that it will be of interest to you if I quote these two letters in full.

Mr. Dewey writes as follows under date of Dec. 30, 1904:

"*Prof. C. G. Hopkins, University of Illinois, Urbana.*

"MY DEAR MR. HOPKINS—I enclose with this a plat of the field upon which the thirty tons of phosphate rock was sowed last spring. The portion of the plots, their treatment and area and the yield per acre of each is indicated. I send this as partial payment for the bone meal (1,000 ℔.) the experiment station sent me to check against the rock. For the rest of the payment please accept my gratitude for your kindness.

"In determining the yields a certain number of rows, generally sixteen or a day's husking was taken from as near the center of the plot as possible. In plots VI and IX the tests were made of rows adjacent to the plots to be compared. Rows of corn upon the dividing lines of two plots were not included.

"The returns from all the plots I am sure are reliable, save in plot I. My man here, perhaps accidentally, I fear, maliciously, mixed things up and no reliance can be placed on his record. The yield indicated by his work was 55.6 bushels. Of course he was eliminated immediately from the experiment but the true yield of plot I is lost. Plots II, III, V and VI (west end) must rely on plot IV for their check.

"On this basis, plot II shows an increase of 5.1 bushels from the application of one ton rock per acre—an increase of 9.8 per cent over the area not treated (plot IV) while plot III, where one-half ton of rock per acre was applied, shows an increase of 3.2 bushels or 6.1 per cent over the control. (Plot IV.) On the east of the control plot is an area of two acres upon which 200 lbs. per acre of bone meal was spread. Its yield is nearly that of plot II being 5.7 bushels increase or 10.9 per cent.

"In plot VI (west end) we meet a surprise in that the half ton of rock makes a better showing than the bone meal. There is a gain of 6.6 bushels or 12.6 per cent. There is a very gentle slope as we proceed from the west side of the field to the center of plot VI so that the difference in yield between plots III and IV (west side) of 3.4 bushels is explicable as plot VI (west side) lies a trifle lower and this season this was an advantage. Upon all these plots about eight tons of manure was scattered by means of a manure spreader, the fall previous and turned under in the fall. Would not this experiment indicate that for such a season as 1904 that manure and rock one-half ton per acre is as valuable as manure and 200 pounds bone meal?

"The eastern plots were upon fall plowed ground that had received no application of manure the year previous. It lay generally higher too, which was unfavorable for large yields last year. The control made a yield of 39.7 bushels while the areas receiving one-half ton of phosphate rock [plot VI (east end) and IX (west end)] made an average yield of 44.6 bushels. These two plots vary very little from this average. This average is an increase of 4.9 bushels over the control or 12.3 per cent. When 200 pounds bone meal was applied our increase is 8.5 bushels or 21.4 per cent over the plot receiving no treatment. Bone meal in soil deficient in humus seems to be quite superior to the rock. During the growing season there seemed to be no difference in the plots so that the result of the husking came as a surprise to me. The only visible difference was in the amount of down corn, plots IV and VIII suffering much worse than the treated areas, so much so that the man shucking out plot VIII suggested I give him an extra ½-cent per bushel for the work. As the area was small I didn't take kindly to the suggestion.

"You sent me 1,000 pounds of bone as I intended to apply 250 pounds per acre of it which is about equivalent in price to one-half ton of rock. But as the sacks containing the bone were delivered in bad condition, I received a little less than 900 pounds and so applied but 200 pounds per acre to the four acres tested.

"I cannot but think the results quite remarkable as I expected no returns the first year from the rock. Especially am I surprised that we should get results during such a season. The spring opened very late so that the application was made immediately before the disking before the planter. After the season once opened it was very dry throughout the summer and fall—a feature generally unfavorable for a good showing for fertilizers. I shall put this field in corn again next season and then we will expect great things indeed.

"A sample of soil taken from plot VI at the point indicated by the star was analyzed in the soil fertility laboratory last year with the following result:

	Per cent Nitrogen.	Per cent Phosphorus.	Per cent Potassium.
No. 1—Depth 1 inch to 7 inches.	.2757	.043	.539
No. 2—Depth 7 inches to 16 inches	.1604	.023	....
No. 3—Depth 20 inches to 26 inches	.0645	.020	....

"It will be seen that while the nitrogen content is nearly up to standard and with potassium far above, the phosphorus per cent is not half what it should be.

"Pot cultures were also run from soil taken from this point. I have not as yet received the data from these pot cultures, but Mr. Eckhardt has it at hand and can furnish it to you if you would like it. With these field tests reported here, the chemical analyses, and the pot cultures I feel that I know this soil quite thoroughly.

"I wish to thank you again for your assistance and to express to you my entire willingness to undertake the solution of any problem in soil fertility, etc., that I am able to do. I will be glad to hear from you at at any time,

Yours truly,
JAMES A. DEWEY."

Mr. Winship writes as follows:

"PUTNAM, PUTNAM CO., ILL., Jan. 16, 1905.

"*Professor C. G. Hopkins:*

"DEAR SIR—Last winter I wrote you concerning soil fertility and fertilizers and thought it might interest you to hear the result. In all, I applied ten tons of ground limestone on old clay soil and twenty-two tons of phosphate (Tennessee rock) on both clay and prairie soils, 600 to 800 pounds per acre on both oats and corn land. My experiments agree very closely with the published results of your experiments. On oat land in corn stalks I applied 600 pounds per acre, without the aid of legumes or manure, and sowed clover seed at same time, all at oat seeding time. The increase in oat yield was six bushels per acre or about one bushel increase for each 100 pounds rock phosphate. The growth of clover was great, and was the admiration of all my neighbors. On corn land I applied 600 to 800 pounds rock phosphate per acre, partly in connection with manure, partly with clover, partly without either, and on the clay I also applied 1,400 to 1,800 pounds ground limestone per acre. On one experiment plot I applied ten loads cow yard manure, largely mixed with dirt, and fine the fall before, and in the spring following applied 1,400 pounds rock phosphate and 1,800 pounds lime per acre, and on this plot of old, worn clay, I raised ninety bushels corn per acre of first quality, and there was scarcely a barren stalk on the plot. Ten loads manure and 800 pounds phosphate, 1,800 pounds lime produced eighty bushels corn; and the same lime and manure, 600 pounds phosphate, gave seventy to seventy-five bushels of corn per acre; phosphate and clover and lime, eighty bushels per acre; phosphate alone gave an increase of one bushel of corn to each 100 pounds rock phosphate. The phosphate and lime were sown on fall plowing and disked in. I sowed clover in the corn at last plowing and got a good stand. The above all on worn clay land. The oats were sown on prairie soil. I applied 600 pounds rock phosphate per acre to ten acres prairie corn land, but did not apply manure, and the field had been cropped in corn and oats for several years; the increase in yield was, however, the same as on the clay, one bushel for each 100 pounds of rock phosphate. Therefore, I conclude that 500 pounds rock phosphate is not enough for the first application. Ten loads of manure and 1,000 pounds of phosphate make a nice application. but I think more phosphate is better. One thing surprised me and that was, the more natural fertility the soil contained the more marked was the increase where the phosphate was applied. I should have stated that the above clay fields would have produced forty bushels per acre this year without fertilizers, as it was a very favorable year for corn, and that was the yield on the fields not fertilized. I am so well pleased that I shall apply twenty-five tons more rock phosphate this year.

Yours respectfully,

J. O. WINSHIP."

Probably the most reliable and valuable experiments ever conducted with raw rock phosphate are those in progress at the Ohio Experiment Station, where careful field experiments with the use of this material in connection with farm manure and clover have been carried on during the past eight years, duplicate experiments having been made each year with each of the different crops included in a three-year rotation of corn, wheat and clover. Based upon the increased crop yields produced where ground rock phosphate was mixed with the manure previous to the application of the manure to the clover sod to be plowed under for corn, as compared with the use of the same manure without rock phosphate, these soil experiments have shown that the addition of the ground rock phosphate increased the value of the manure more than 60 per cent. In other words, as an average of forty-two different tests extending over a period of seven years (I have not yet seen the results for 1904), the average value of farm manure was found to be $1.99 per ton, measured in increased crop yields produced; but, when forty pounds of finely ground rock phosphate were added to the ton of manure, its average value was found to be $3.23 per ton, making an increased value due to the addition of the phosphorus of $1.24 per ton of manure.

At the present price of ground raw rock phosphate delivered in Illinois, namely $8.00 per ton, the forty pounds of raw rock phosphate would cost 16 cents, which would leave an added net profit of $1.08 for every ton of manure with which the phosphate is mixed. It is worthy of special note that in this same series of Ohio experiments 16 cents' worth of raw rock phosphate has produced almost as large an increase in the crop yields as 30 cents' worth of ordinary acid phosphate, the use of which gave an added net return of $1.18 for each ton of manure with which the acid phosphate was mixed. As an average of forty-two tests with each material, $1.00 invested in raw rock phosphate made a net profit of $6.75, and $1.00 invested in acid phosphate made a net profit of $3.93. Furthermore the forty pounds of untreated rock phosphate is enriching the soil in phosphorus twice as much as the forty pounds of acid phosphate; consequently, in the long run, the untreated rock phosphate must produce the more lasting results.

METHODS OF USING ROCK PHOSPHATE.

In my opinion somewhat larger quantities of the raw rock phosphate should be mixed with the manure to insure the maximum profitable crop yields on soils deficient in phosphorus. I am practicing and advising the addition of 100 pounds of finely ground rock phosphate to be mixed with each ton of manure. The phosphate may be scattered over the manure from day to day as the manure is being made in the stable or in the feed lot; indeed, this appears to be the ideal method of using it; or, when loading the manure onto the manure spreader from the yard or stall, the spreader box may be loaded half full, then 100 pounds of rock phosphate scattered over the manure as uniformly as possible, and after completing the load of manure it may be hauled to the field and spread.

If farm manure is not available, then I advise applying from 1,000 to 2,000 pounds of finely ground rock phosphate per acre every three to six years, depending upon the length of the rotation. In this case the phosphate should be applied to clover sod or to catch crop of cow peas, soy beans, etc., and plowed under with as much organic matter as practicable. With a three-year rotation of corn, wheat and clover, or corn, oats and clover, 1,000 pounds of rock phosphate may be applied to the clover sod and turned under, preferably in connection with the second crop of clover, which often is worth more to turn under than it is to cut for seed. With a six-year rotation of corn, oats, wheat, clover, timothy, and pasture, one ton per acre of rock phospate may be applied to the pasture-ground in connection with farm manure and plowed under for corn, preferably with a considerable growth of grass and clover.

In considering the purchase and use of finely ground rock phosphate, attention is called to the fact that this is a form of phosphorus originally provided in the soil by nature. Virgin soils do not contain bone meal or acid phosphate.

It is fast becoming evident that we can profitably use raw rock phosphate in sufficient quantities for more than maximum crop yields and thus gradually actually enrich the soil in that element, but we still have to provide for the permanent maintenance of a sufficient supply of nitrogen and potassium.

THE SUPPLY OF POTASSIUM IN ILLINOIS SOILS.

It should always be borne in mind that our ordinary soils are exceedingly rich in potassium soluble in strong acids, as determined in the ordinary chemical analysis. Thus, the common prairie soils of the corn belt of Illinois contain more than 8,000 pounds of acid-soluble potassium per acre to a depth of seven inches, and even larger amounts in clayey subsoils. In addition to this it should also be kept in mind that only one-fourth of the total potassium in the soil is soluble in this acid solution, although it is by no means sure that much of the so-called insoluble potassium will not be made available by the same system of farming which seems necessary to make raw rock phosphate available, namely, by a liberal use of decaying organic matter, as farm manure, legume crops and catch crops, and other green manures. Please note these figures: One hundred bushels of corn contains nineteen pounds of the element potassium. If the corn stover is kept on the farm, either by burning in the field, or by cutting and plowing under, which is a much better practice as a rule, or by feeding and returning the manure to the land, which is probably the best practice, in either case if only the grain is sold from the farm the total loss of potassium is but nineteen pounds for a 100-bushel crop of corn. The 8,000 pounds of acid-soluble potassium contained in the plowed soil of one acre is sufficient for 420 100-bushel crops of corn; while the total potassium in the plowed soil of the average land of the corn belt is sufficient for a 100-bushel crop of corn every year for 1,700 years. Considering this enormous supply of potassium and the additional fact that applications of potassium to this soil commonly produce an injurious effect on the corn crop, we are not ready to use any so-called "complete" fertilizer containing two pounds of potassium to the 100, not even if we do sell nineteen pounds of potassium in 100 bushels of corn.

It should be understood that if all crops grown on the farm are fed, plenty of bedding being used and all solid and liquid manure returned to the land, the original supply of potassium will be indefinitely maintained; and even if some of the most valuable grains are sold from the farm the loss of potassium is insignificant compared with the enormous store in our soils.

Of course on soils already deficient in potassium, as peaty swamp soils, potassium should be applied in some form preferably and most cheaply as potassium chlorid or potassium sulphate, unless one has abundance of farm manure not needed on other land.

THE SUPPLY OF NITROGEN FOR ILLINOIS AGRICULTURE.

Regarding nitrogen it may be said that no agricultural fact is better established than this: That the atmosphere is the only inexhaustible and the most economical source of nitrogen for plant food for all general farming. With good drainage and good physical conditions and with abundance of phosphorus and potassium provided, about the only possible difficulty in the way of successful crops of clover or other legumes in normal seasons is the present or future acidity of the soil. All soils tend to become acid with long cultivation. Many reactions going on naturally in all good soils tend to destroy the limestone and other basic or alkaline materials in the soil; thus there is already a need for some form of lime on some Illinois soils of great area and there will be a continuous need for such material on still larger areas as time goes on. Consequently it seems that some mention of the lime question must be made in connection with nitrogen and legumes, for both the nitrogen-gathering bacteria and the nitrifying bacteria are not active and effective in acid soils.

THE USE OF LIME ON SOILS AND THE KINDS OF LIME TO USE.

There are two distinctly different forms of lime: One is known as caustic lime or burned lime and the other as carbonate of lime or the natural form, such as limestone or marble.

There are two principal effects produced by using lime on soils: One of these is to correct the acidity of the soil and the other is to decompose the soil itself. To correct the acidity of sour soils is certainly a very desirable and profitable use of lime. Clover, alfalfa, alsike, cowpeas, soy beans and many other legumes will not thrive on soils which are strongly acid. To be sure such crops can be made to grow on acid soils by liberal applications of farm manure or other complete fertilizers, but the nitrogen-gathering bacteria of the legume plants do not properly develop and multiply in acid soils and consequently the legumes do not have the power which they should have to accumulate large quantities of atmospheric nitrogen by means of the bacteria which inhabit, or should inhabit, their roots. Furthermore, the process which is termed nitrification by which the nitrifying bacteria transform the insoluble organic nitrogen, in farm manure and plant residues, into soluble nitrate nitrogen, the form in which it becomes available as plant food, is greatly promoted by the presence of lime and retarded by acid conditions.

It will thus be seen that the use of some form of lime for correcting the acidity of soils and thus encouraging the growth of clover and other legumes with their wonderful power to enrich the soil is certainly good farm practice.

Any form of lime which is finely divided and can be thoroughly mixed with the soil will serve to correct the soil acidity, whether it be ground limestone, marl, or chalk, or fresh burned lime, water-slacked lime, or air-slacked lime.

The other effect produced by lime, the effect for which it has been most used in past ages, is the decomposition of the soil itself. In this decomposition the organic matter of the soil is destroyed with the liberation of nitrogen and phosphorus held in organic form and the mineral particles of the soil are disintegrated with the liberation of some plant food elements, as potassium and phosphorus held in organic form. This effect is produced only by fresh burned lime or fresh slacked lime. It is not produced by ground limestone or by old air-slacked lime.

Thus it will be seen that the first effect of lime, the correction of soil acidity, results in a building-up process through the increased growth of legumes and nitrogen-gathering bacteria; while the second effect, the decomposition of the soil, is in all respects a destructive process, serving only to liberate and reduce the stock of plant food stored in the soil. Whether this second effect is desirable will depend upon the nature of the soil itself. On soils which are exceedingly rich in organic matter, such as peaty soils and other swamp soils, it would seem altogether rational to make use of caustic lime to hasten the decomposition of the soil and consequent liberation of nitrogen, if such treatment is necessary.

There may possibly be conditions under which soils contain large amounts of phosphorus and potassium, which are too slowly available for profitable crop production, and in such cases it might be good farm practice for a time to make use of caustic lime to hasten the liberation of these mineral elements of plant food. We should bear in mind, however, that this use of lime on a soil which is already deficient in nitrogen, phosphorus or potassium only serves to still further exhaust the soil of its meager supply of those elements. Without a doubt this is the most common condition and the most common effect of the use of caustic lime (fresh burned lime or water-slacked lime). Probably no method of treatment will exhaust such lands more rapidly than heavy or frequent application of caustic lime. It is true that the immediate effect is usually somewhat increased crops, but it should be borne in mind that when a farmer pays out money for caustic lime to be used for this purpose he is purchasing only a stimulant which will ultimately leave his land in worse condition than before, especially in the loss of nitrogen and organic matter, and in the exhaustion of phosphorus and potassium from the soil. In other words, this use of lime if continued tends rapidly to exhaust the soil and ultimately to leave it practically ruined. In this connection it may be stated that gypsum or land plaster produces a similar effect as far as the mineral elements are concerned, although it does not effect the destruction of the organic matter as the caustic lime does.

As a general rule, the farmer should use lime only to correct the acidity of the soil, and this is only necessary where there is difficulty in obtaining a good stand and luxuriant growth of a leguminous crop, such as red clover. Probably one ton to the acre will be sufficient on any soil which has in past years grown red clover successfully. Heavier applications may be required on soils where red clover has never been successfully grown. As to the form of lime to use for this purpose, the farmer should be governed very largely by the cost of the material. Fine-ground limestone will be the most economical form of lime to use wherever it can be easily obtained.

It would be expected that burned lime would produce a greater increase in the crops for the first year or two than would be produced by the ground limestone, more especially where the mineral elements, phosphorus and potassium, are not applied, for the reason that ground limestone produces practically no effect except to correct the acidity of the soil and thus encourage the multiplication and activity of the nitrogen-gathering and nitrifying bacteria, whereas, the burned lime not only produces this same effect, but it also acts as a soil stimulant, or soil destroyer, attacking and destroying the organic matter and decomposing the mineral constituents and thus liberating plant food from the soil. The use of ground limestone to correct acidity and increase the fixation of atmospheric nitrogen is certainly altogether legitimate and commendable, but to use burned lime to force the soil to give up plant food more rapidly than it would otherwise furnish, thus producing an increase in the first few crops, but ultimately leaving the soil more impoverished than before the lime was applied, is not thought to be advisable or profitable in the long run, unless the soil contains comparatively large stores of unavailable plant food and abundant organic matter, which is certainly not the case with most soils.

In this connection it seems very appropriate to call attention to a series of experiments which have been carried on by the Pennsylvania Experiment Station, probably the most extended investigation ever conducted relating to the use of burned lime and ground limestone in comparative tests. Four plots were treated with burned lime (slacked before being spread) at the rate of two tons per acre once in four years. Four other plots were treated with ground limestone at the rate of two tons per acre every two years. A four-year rotation was practiced, consisting of corn, oats. wheat and hay, the hay being mixed timothy and clover, seeded on the wheat land in the spring. By having four sets of plots, each crop was grown every year. Seven products were obtained and weighed each year, namely, corn, corn stover, oats, oat straw, wheat, wheat straw, and hay.

After twenty years' results had been obtained (1882 to 1901), the Pennsylvania station reports data showing that with every product a greater total yield had been obtained from the plots treated with limestone than from those treated with burned lime. This is certainly significant. Furthermore, with every product whose total yield for the last eight years was greater than the total yield of the first eight years the limestone produced a greater increase than the burned lime; and with every product whose total yield for the last eight years was less than the total yield for the first eight years, the decrease was less where limestone was used than where burned lime was applied (oat straw alone excepted). This is even more significant, in that it demonstrates the tendency of burned lime with continued use to exhaust or destroy the fertility of the soil.

After these experiments had been in progress for sixteen years, the soil of each of the four plots in each test was sampled for analysis. The average nitrogen content of the four plots receiving ground limestone was found to be 2,979 pounds per acre to a depth of nine inches, while only 2,604 pounds were found in the soil treated with burned lime. This difference of 375 pounds of nitrogen is equal to the nitrogen contained in thirty-seven and one-half tons of farm manure. In other words, the data indicate that the effect of burned lime as compared with limestone was equal to the destruction of thirty-seven and one-half tons of farm manure in sixteen years, or more than two tons a year to the acre.

The estimation of humus in these soils, based upon the determination of organic carbon showed the soil receiving limestone to contain 38.9 tons of humus per acre to a depth of nine inches (counting 300,000 pounds of soil to the acre-inch), while only 34.2 tons of humus remained in the soil treated with burned lime. If four tons of farm manure contain only one ton of dry matter (average fresh farm manure contains about 75 per cent of water), and if two tons of such dry matter would be required to make one ton of humus (when exposed to the weather manure usually loses half of its dry matter content within one year or less), then this difference of 4.7 tons of humus would be equal to 37.6 tons of fresh farm manure, which represents the loss from the destructive action of burned lime as compared with ground limestone.

If it is true, as indicated by the Pennsylvania experiments, that eight tons of burned lime, applied during sixteen years, destroyed organic matter equivalent to thirty-seven tons of farm manure, or more than four and one-half tons of manure destroyed for each ton of burned lime used, as compared with ground limestone, and if larger crops were obtained where limestone was used, especially where the practice is extended over several years, and, if the ground limestone is sustaining the productive capacity of the soil much better than burned lime, then, as a very general rule, we should avoid applying burned lime to the land, but make liberal use of ground limestone where needed to correct the acidity of the soil. And may we not call attention to the fact that limestone is the form of lime originally provided in the soil by nature? Among the most valuable and durable soils in the world are the limestone soils. They do not contain burned lime.

SUMMARY.

In summarizing, I would say that while we do not have complete, definite, and final knowledge regarding all questions involved, we certainly do have sufficient information and data to justify a decision to discard any agricultural system which continually decreases the amount of any element of plant food which is already so deficient in the soil as to limit the yield of crops, to discard any system which ultimately and inevitably must leave an impoverished land and an impoverished people, indeed, to discard any system under which the soil is made to produce smaller crops than when first the virgin sod was broken, to discard the use of gypsum and caustic lime as stimulants or soil-destroyers for the sole purpose of forcing the soil to give up even more of some deficient plant food element than it would otherwise furnish, and even to discard the use of acid phosphate when applied in such small quantities that a good crop is obtainnd only by the combined effect of the phosphorus added, together with that naturally liberated from the soil and that forced from the soil by the manufactured gypsum contained in the acid phosphate.

Can we not adopt a system of profitable farming which shall permanently insure a high productive capacity of the soil and which shall be of unlimited practical application? I firmly believe we can. For ordinary soils I believe such a system will include:

1. Thorough underdrainage wherever needed.
2. Applications of ground natural limestone whenever necessary to correct and prevent soil acidity.
3. Continued use of large quantities of fine ground natural rock phosphate (or some other form of phosphorus) in connection with decaying organic matter by which the phosphorus is made available, and by this means gradually increasing the total phosphorus content of the soil, even though maximum crops are removed.
4. Liberal use of clover and other legumes in rotation and as catch crops, by which nitrogen and organic matter will be added to the soil.
5. Feeding of all crops excepting some of the most valuable grains or other high-priced products and returning all manure to the land, by which means the supply of potassium, the most abundant plant food element in our common soils, will be practically maintained. The manure together with the legume crop residues will effect an increase or permanent maintenance of the supply of nitrogen and organic matter in the soil.

With the use of sufficient limestone to keep the soil sweet and abundant use of legume crops and catch crops, and the addition to the soil of a ton of ground rock phosphate, or its equivalent, every six or eight years, in connection with all of the farm manure which can be made, the ordinary lands of the central west can be made to grow large crops indefinitely.

This, I believe, will be the Illinois system and the system for general farming on the ordinary soils of all the states here in the great agricultural west, the present and, may we say, the future granary of the world. Essentially by this system of soil improvement and soil maintenance, I believe the farmers and landowners of the Central United States will reject the world's historic verdict: "Westward the course of empire takes its way," and erect a new standard which shall say: "Here a permanent Agriculture holds sway."

THE PURCHASE AND APPLICATION OF MATERIALS.

Ground limestone can be obtained for about $1.00 a ton (and freight) from the Crystal Carbonate Lime Company, Elsberry, Mo., or from the Mitchell Lime Company, Mitchell, Ind. So far as known to the writer, there is no place in Illinois where finely-ground limestone is offered for sale, although there is excellent limestone in many places in the State, especially along the Mississippi river, as at Quincy, and in the Ozark hills, in the southern part of the State, as at Anna.

Steam bone meal can be obtained for $25.00 to $30.00 a ton from local agents of Armour Fertilizer Works, Morris & Company, Swift & Company, and other packers of the Union Stock Yards, Chicago, Ill.

Ground rock phosphate can be obtained in carload lots for about $8.00 a ton (including freight) from Robin Jones, Nashville, Tenn., or from the N. Y. & St. L. Mining and Mfg. Company, St. Louis, Mo.

Steamed bone meal can be applied with any good force-feed seeder or with a fertilizer drill. Ground rock phosphate or ground limestone can be applied with an endgate seeder or with an "agitator-feed" grain seeder, but neither of these is made of sufficient capacity or strength for very satisfactory use, and they are sometimes broken when used to sow these materials. The most satisfactory implement which we have tried for making heavy applications of limestone or rock phosphate is the Stevens Fertilizer Sower, which sows a strip 8 feet 3 inches, (½ rod) wide. This is manufactured by the Belcher & Taylor Agricultural Tool Company, Chicopee Falls, Mass. This machine costs about $40.00 and freight, while an "agitator-feed" seeder of the same width can be bought from local agents of Illinois manufacturers for $16.00 to $18.00.

The Ohio Experiment Station reports that a very satisfactory machine for sowing limestone, rock phosphate, etc., can be made for less than $20.00 by a blacksmith and a carpenter, using a pair of old mower wheels to start with.

The axles are cut off a few inches from the wheels and a strong rod about 8½ feet long welded or bolted onto these axles, thus putting the wheels about nine feet apart and retaining the use of the ratchets in the wheels. A box or hopper is built with a double bottom, the lower one being made to slide endwise and thus to open or close the holes which are made through the double bottom. The rod connecting the two wheels runs through the box near the bottom and some sort of iron straps are attached to this axle rod, about the same as in the "agitator feed" seeders, so that when a tongue is attached to the box frame and the machine drawn forward, the axle rod rotates with the wheels and forces out the material in the box, thus distributing it broadcast on the land.

Wherever possible the rock phosphate should be mixed with manure as it is being made in the stall or covered feed lot.

Gentlemen of the Illinois State Farmers' Institute, I ask you to pardon me if I make some personal remarks. The Illinois State Farmers' Institute is the organization which first asked for an appropriation for the investigation of Illinois soils. For that reason this organization stands as a guardian over the soils of this State, that their fertility and productive capacity may be preserved for all future generations; and it seems to me entirely appropriate that what I am about to say I should say to this organization.

After I had become convinced that the low-priced lands of the lower Illinois glaciation, comprising about twenty-five counties in southern Illinois, could be profitably improved, and after the results of investigation showing marked improvement in those soils had been published and republished throughout the State, I bought a farm in southern Illinois, expecting to improve it. My object or purpose in the investment was three-fold; first, personal financial gain from the profits of the business; second, a closer personal touch with the practical business of improving a worn out farm; third, a desire to demonstrate on a good sized farm, and with my own money, that such improvement by practical scientific methods is possible and profitable.

Again after I had become convinced that the element phosphorus is deficient in most Illinois soils, that this element must be applied to many of our soils if they are to produce and continue to produce maximum profitable crop yields, and after these facts and the data upon which they were based had been published and republished throughout the state for two years, I bought phosphorus; I invested in a phosphate company; I secured all the phosphate stock I could obtain; and I suggested to others, as I have had opportunity, that they might well do the same. Here, again, my object or purpose was three fold; first, to secure a supply of phosphorus for my own farm; second, personal financial gain from the phosphate stock obtained; third, the desire to have Illinois farmers and land owners obtain control, if possible, of a supply of phosphorus sufficient for the needs of Illinois soils.

Under the authority of the University of Illinois and the director of the agricultural experiment station and the advisory committee from the State Farmers' Institute, I am charged with the investigation of Illinois soils; but I have assumed that after the facts above referred to had been widely published throughout the State, then I had the same right as any other citizen of Illinois to invest in southern Illinois land, to purchase phosphorus, to secure stock in a phosphate company, or to advise others to do the same.

I mention this matter because some are reported to have raised the question whether I ought to have taken any interest in a phosphate company or to have induced Illinois farmers or others interested in Illinois agriculture to invest in phosphate property.

Certainly I would have no right to keep secret any information relating to the investigation of Illinois soils until I should profit therefrom or thereby obtain some undue advantage, but I have assumed, and still assume, that after such information has been given wide publicity then I would have the same right to profit from those investigations as has any other citizen of this State. I believe this would be true even if the phosphate deposit were in Illinois and if it were the only source of phosphorus for this State; but as a matter of fact, this phosphate property is only a part of the great phosphate deposit in Tennessee. It is not necessary that any Illinois farmer should ever purchase phosphorus from the company in which I am interested (there are others); neither is it necessary for the success of this company that it should ever sell a ton of rock phosphate in Illinois; the markets of the world are open and a million tons is the annual American export.

I believe it is due to this association and to the experiment station, to myself and to my associates that I should present to you a brief chronological history of these transactions:

The first appropriation for the investigation of Illinois soils became available July 1, 1901.

In July, 1902, one year later, Bulletin No. 76, "Alfalfa on Illinois Soils," was published, in which it was shown on the ordinary prairie soil of Illinois, as in Champaign county, that "applications of phosphorus to this soil were greatly to the advantage of the alfalfa crop."

On Sept. 29, 1902, I made a report of progress to the board of directors of the Illinois State Farmers' Institute on the "Investigation of Illinois Soils," which was soon afterward published and widely distributed by the institute and experiment station. In this report it was pointed out that the soil analyses which had been made showed that the principal types of soil in several very large soil areas in the State were deficient in phosphorus.

Whenever I have suggested the advisability of using any material on the soils of Illinois, I have always tried to make it possible for any one to adopt the suggestion and for this reason I have constantly followed the practice of stating in reports and bulletins where such materials could be obtained, never for the purpose of advertising anybody's goods, but always to give Illinois farmers necessary information, which, if it were not given in the bulletins, would be called for by thousands of letters. Thus, in this report I stated that we had obtained pulverized lime from the Marble Head Lime Company, of Marble Head, Ill., and from J. B. Speed & Company, of Milltown, Ind.; ground limestone from the Crystal Carbonate Lime Company, of Ellsberry, Mo.; bone meal from the Armour Fertilizer Works, Union Stock Yards, Chicago, and potash salts from the German Kali Works, of New York.

On February 25, 1903, I gave an address before the Illinois State Farmers' Institute at Bloomington on the subject, "Methods of Maintaining the Productive Capacity of Illinois Soils," which was soon afterward published by the experiment station as Circular No. 68 and distributed to the station's entire mailing list in Illinois. In that address I presented data from chemical analyses, from pot cultures, and from field experiments, all showing the great need of phosphorus for improving and permanently maintaining the productive capacity of most Illinois soils. Some of the statements which I made to this organization at Bloomington, two years ago this month are as follows:

1. "Nitrogen is free as air and potassium is abundant in nearly all of the soils of the State, and both nitrogen and potassium remain in the straw and corn stalks and in the farm manures to a considerable extent. Phosphorus, on the contrary, is present in nearly all soils in limited amounts and it is being continually removed from the land both by grain farming and live stock farming, although two or three times faster by grain farming than by the live stock system of farming.

2. "I believe that the purchase and intelligent use of phosphorus on many Illinois soils will ultimately pay a higher interest on the investment than the purchase of Illinois soils themselves.

3. "Phosphorus is the one element of fertility above all others which has a high absolute and permanent value to Illinois farmers.

4. "If there is any one factor more potent than others to finally ruin the agriculture of this State, to reduce all our lands to the level of the wornout lands of the eastern states and of the countries of Europe, many of which cannot today produce their own supply of bread, I say if there is any one thing which shall ultimately bring this condition upon us or upon our children, I believe it is the loss of phosphorus."

I described, in that address, the three chief sources of phosphorus and mentioned that steamed bone meal could be bought "from fertilizer dealers in Chicago (as Nelson Morris & Company, Armour Fertilizer Works, or Swift & Company)," that ground rock phosphate could be bought "from Robin Jones, of Nashville, Tenn.," and that slag phosphate could be obtained "from Jacob Reese, Pottstown, Pa."

In August, 1903, I prepared Bulletin No. 88, "Soil Treatment for Wheat in Rotations, with Special Reference to Southern Illinois Soils," which was at once published and distributed to the station's entire mailing list. In this I especially emphasized the need of phoshorus on southern Illinois soils. I suggested the two forms, steamed bone meal and ground rock phosphate. I expressed the opinion that farmers who desired to try phosphorus on their land would have no difficulty in obtaining pure bone meal from such firms as "Nelson Morris & Company, Union Stock Yards, Chicago, Armour Fertilizer Works, Swift & Company, or from several other companies located at the Union Stock Yards."

On Nov. 17, 1903, I read an address before the Section of Agriculture and Chemistry of the Association of American Agricultural Colleges and Experiment Stations at Washington, D. C., which was soon afterward published by the Illinois Experiment Station as Circular No. 72, and distributed to the agricultural press of Illinois and to all others who asked for it.

Following are some of the statements which were made in that address:

"We have in Illinois an area of land whose principal type of soil contains only 600 pounds of phosphorus an acre in the plowed soil to a depth of seven inches. A goo crop of corn, such as we commonly produce on the best soils in the State, removes from the soil twenty-three pounds of phosphorus an acre. Twenty-five or thirty good crops would actually remove from the soil as much phosphorus as is contained in the plowed soil, and the plowed soil is considerably richer in phosphorus than the soil below it.

"It is mathematically impossible that the supply will be indefinitely maintained if good crops should be removed from this land for any considerable number of years. The question is asked if this is not a very small area of abnormal soil. It is true that this area is a fraction of the State of Illinois, but nevertheless it is large enough to make eleven states the size of Rhode Island. In former years this part of Illinois supplied sufficient corn to the rest of the State so that it was nicknamed Egypt; and it is still popularly known by that name."

It was also in November, 1903, that I purchased my "Poorland" farm in Marion county, in the heart of Egypt, a farm which during the previous five years had not paid the owners 2 per cent interest per annum on the price at which I purchased it.

Twenty-one months after Bulletin No. 76 was published, eighteen months after the general need of phosphorus had been given wide publicity, and fourteen months after I had made the most positive statements before this organization that the loss of phosphorus threatens ultimately to ruin the agriculture of Illinois, in April, 1904, I first learned of the phosphate company in which I afterward invested and in which I now own stock.

In securing an Illinois farm and in securing stock in a phosphate company, I am practicing what I preach, fully believing that the people who are interested in Illinois agriculture are not only willing that I should own stock in Illinois soil and in Tennessee phosphate, but that knowing these facts will increase your confidence in the work which we are doing in trying to discover and in helping to establish a system of farming which shall insure a profitable and a permanent agriculture in the commonwealth of Illinois.

A profitable and permanent agriculture! Let this be our goal. Let this be the motto of every citizen of Illinois. And let us begin now while we are rich and prosperous and powerful. Let us not repeat in Illinois the history of such lands as the great Mohawk valley in New York and the James River valley in Virginia, both of which were once famous for their fertility and productive capacity and both of which are now practically ruined.

I have knowledge at the present time of a large farm in the state of New York which more than half a century ago sold for $125.00 an acre and which today is offered for $23.00 an acre, which is less than the cost of the buildings now standing on the farm.

Prof. Joseph Carter of Champaign, well known to the teachers and farmers of Illinois, recently stated in a public address that within the past two years he had traveled through the valley of the James river in Old Virginia. He found there that some of the beautiful farm lands which once grew the great crops of tobacco that made Virginia rich are now absolutely abandoned and no man will own them.

I repeat what I said at your annual meeting two years ago:

"The fertility of Illinois soils ought not and need not be reduced; Illinois land ought never to be reduced below its original productive capacity."

"If he who makes two blades of grass grow where but one grew before is a public benefactor, then he who reduces the fertility of the soil so that but ear of corn grows where two have been grown before is a public curse."

After Professor Hopkins completed his address, Director H. G. Easterly of Carbondale presented a supplementary report for the committee on resolutions and moved its adoption.

The motion was seconded and carried.

The supplementary resolutions follow:

WHEREAS, Many successful dealers are selling to the dairymen and stockmen of this State, feed stuffs adulterated with non-nutritious and harmful substances; and,

WHEREAS, This practice of adulteration has reached such a stage as to demand legislation to rectify the evil; therefore, be it

Resolved, That the bulletins showing the result of the tests of the various feeds be prepared semi-annually, and be printed at State expense for general distribution among the dairymen and feeders of the State; and

Resolved, That we, the dairymen of the State of Illinois, do earnestly pray the present legislature to pass such needed legislation as will require the printing on the bag, bucket or package of the digestible constituents of all chopped, ground or mill feeds and of all so-called stock and poultry foods which may be offered for sale in the State of Illinois; and

Resolved, That all uncut hays, straws and fodder in their natural condition, and that all whole grains, such as corn, oats, barley, etc., shall be exempt from the provisions of the act; and be it further

Resolved, That the president is hereby instructed to appoint a committee of three, whose duly it shall be to investigate the laws of other states and conditions in our own State, arrange a bill to cover our needs and present same to the present legislalure and urge its passage.

Resolved, That the Illinois Farmers' Institute heartily endorses the action of the State Dairy Association in their fight for pure stock foods, and recommend our legislative committee coöperate with any action towards securing the passage of any needed legislation looking toward this end.

(Signed), JAMES FRAKE,
H. G. EASTERLY,
E. W. BURROUGHS,
Committee.

OVERFLOW MEETING IN CASTLE HALL, 2:30 P. M., FEB. 23.

Professor Haecker, of the University of Minnesota, first addressed the meeting upon the topic which he had presented in part at the morning general session, namely, "Feeding the Dairy Cow." A general discussion followed, led first by Editor A. J. Glover, of Fort Atkinson, Wis., and afterwards by Euclid N. Cobb, of Monmouth.

PROF. A. J. GLOVER.

I will try to tell you something of the milk fever cure. It is a very simple one. A few years ago it was discovered that by injecting oxygen into the udder of the cow, after it is entirely emptied of milk, and then massaging it, that nearly every case of milk fever was cured. Another man who did not have oxygen handy, took a bicycle pump and injected air into the udder and massaged it and the cow stricken with milk fever became well. We have had reports from a great many dairymen stating the good results that they have had in using this method. The air is injected into the udder in the following manner: Insert a milk tube which has already been fastened by a small rubber hose to a bicycle pump, into the teat, and proceed to inflate the udder the same as you would a bicycle tire. Inflate each quarter in the same way until you have the udder filled full of air. If you find that the air is oozing out too rapidly, you can put rubbers around the teats to prevent its escape until you are through massaging the udder. If the cow is not up within an hour, repeat the treatment; but I have never seen more than one or two cases where the treatment had to be repeated. Inside of an hour after this treatment has been administered, the cow is usually up and able to walk and apparently in a normal condition. It is a most marvelous thing. I caution you, if you have a case of milk fever, don't try to give the cow medicine, because she is paralyzed and can not swallow. The medicine will go into her lungs and will strangle her. If a bicycle pump is used, it should be thoroughly sterilized in boiling water before it is used. There are companies that are manufacturing instruments for injecting air into the udder that sterilize the air as it passes through the pump into the udder. Air may be injected into the udder for garget, and when it is caked. If the udder is very feverish, of course it will not cure immediately. Antiphlogistine, which comes in cans and can be purchased at all drug stores, is a good thing to rub on the udder. For instance, at the world's fair this year, there was a Jersey cow being led out for exercise and she became frightened by a man flinging a pail of water out, and she crossed her legs and threw herself; her udder came between the ground and her body, and being a large udder, it was severely injured; she was in the test and they were very anxious to have her proceed and not shrink in milk. They injected air into the udder and they also applied antiphlogistine. I heard Mr. Granes say that they did not notice any change in her milk flow, and it was only a few days until her udder was in good condition.

Antiphlogistine is used for human mothers a great deal.

If there are no other questions, I shall turn the discussion over to Mr. Cobb, better known to the people as "Buff Jersey."

Mr. Cobb—The first thing I would like to say is, why have milk fever at all? I never had a case in my own herd or a herd that I have managed, I lay my exemption from it to the care I give the cow before she is fresh. I never give a cow that is to become fresh grain whatever. I take all the grain ration away from her, except perhaps the corn in the ensilage.

A Delegate—For how long a time?

Mr. Cobb—I never force a cow dry. If I have a cow that will give me milk right up to freshening, I let her do it. I have a cousin in Wisconsin that has been a dairyman for forty-five years and he was down at my place two years ago, and at night he saw one of my cows milked. She gave eight pounds of milk and the next morning she had a calf. I milk a cow just as long as she will give milk. Whenever I have undertaken to force a cow dry from any cause, I have had a great deal of trouble in keeping her udder in good condition,

A Delegate—Will she give as good a flow of milk after having the calf as before?

Mr. Cobb—Not for the first thirty days, but for the year's work I find that the results are as good in one case as in the other. For the first thirty days she will not do so well. If I was going to make a special test of a cow for sixty days, or ninety days, then I would desire to force that cow dry, perhaps two months. But for the working herd, the herd that we are feeding and keeping for profit, I find my method best. I am speaking now of dairy cows we keep for profit.

Mr. Glover—Don't you find that sometimes, if you let your cows milk the year round, that their milk gets strong?

Mr. Cobb—We do have that, and in the last two or three weeks the milk is not used to make butter or cream. We use it in connection with some of the other feeding work.

A Delegate—How many pounds of milk do you get out of these cows?

Mr. Cobb—The last month's record of my herd was twenty and three-quarter pounds per cow, for thirty-five head and the test was 5.5. I sold my herd last February—a year ago this month. But that was the last month's record of our cows.

A Delegate—How many pounds for the entire year, generally?

Mr. Cobb—They run from 5,000 up to 9,500 pounds.

A Delegate—What percentage milk?

Mr. Cobb—The herd averaged 5.5.

A Delegate—I would like to ask a question in connection with milk fever. If your cow is thin and you want to get her up in flesh the coming season, how can you get her there without feeding her some grain?

Mr. Cobb—I never have thin cows. I feed to keep every cow in good flesh.

A Delegate—We will find a great many people losing cows that are running on grass.

Mr. Cobb—I know that and I am surprised at my immunity from it. I don't understand why it is. I am satisfied that my way of feeding during the winter months is the proper way, but why I should be immune in the summer time, I do not know. I have seen herd after herd where people have lost cows every year, with the milk fever.

A Delegate—Don't you think that this simple treatment of having a bicycle pump or a syringe there, is a very simple thing?

Mr. Cobb—I think so; for I was down in Connecticut this winter, and Professor Pearson was there from Cornell University. He placed special stress upon one thing—that is, getting germs into the cows' udder in this haphazard bicycle pump and syringe idea. He advocates getting a—I dont know what they call it, but it is one of these soda fountain tanks, and having it stored with oxygen, and having it either at your own place or at some neighbor's; it is good as long as it is sealed; use that in place of the common air. He says then you are not going to take any chances at all, providing, of course, that the tubes you use have been sterilized properly.

A Delegate—How would you sterilize the tubes?

Mr. Cobb—I use a two or three per cent solution of creolin or carbolic acid. Boiling is all right if the appliances will stand boiling.

A Delegate—I have used a tube a number of times and have lost a teat every time.

Mr. Cobb—It was through infection of the tube, no doubt. I have been in barns where they have used a milking tube on account of some soreness of the teat and that tube was taken from the teat, put up in a box and maybe it would be six weeks or two months before it was used again, and may be it was borrowed by a neighbor and not even washed. It would of course aggravate a case instead of helping it.

We have heard a great deal about feeding and you all know that I am a silo crank. I think there is no feed on the farm, in Illinois especially, as cheap as our corn crop. When we ride over this State and do not see a single field of corn all cut and put into the silo, it seems as though we ought to give special attention to this matter, which is of such great importance. Bulletin (155) of the Ohio (?)

station is right along this line. It is an experiment conducted there this last year, to see how much of the dry matter of the cow's daily ration could be gotten out of the silo and cheap forage, and the results have been very marked in that direction. Professor Haecker cautioned about jumping to conclusions. That is a good thing. We have jumped at a good many conclusions and have been in error. The five months experiment of the Ohio station shows that 82 per cent of the cow's daily ration was taken from the silo and the hay mow. They only fed six pounds of clover hay and four pounds of grain, the balance was ensilage. The ensilage cattle produced milk at 68 cents a hundred and butter at 13 cents a pound. The grain cattle that got 50 to 60 per cent of their feed from the grain, gave milk that cost a dollar a hundred, and the butter cost 25 cents a pound and month's feed over $5.00. The silage fed cows were fed at a cost of $2.50 per month. If we can draw conclusions from a five month's test, that looks to me as though the farmers of this country should pay more attention to the great waste of the corn fields of the State.

I am satisfied that this experiment is correct, because I have practiced this for three years. Three years ago I told my boys that it seemed to me that we were feeding too much grain. We had to feed our best cows twelve pounds of grain and from that down to six. And with our little Jerseys, we commenced to see what we could do in the way of reducing this expensive grain feed. Our cows only got from thirty-five to forty-five pounds of ensilage as we found they would eat that much clean. If we gave them a little too much, we would go to the manger and find the stubs of the cornstalks and the cobs there; so we commenced by feeding about twelve pounds in the morning and twelve to fifteen pounds at noon, or eighteen as the case might be, and fifteen or eighteen at night. In that way we induced the cows to clean up their mangers. By doing that we did not reduce the grain ration as much as the Ohio people did because we did not have the clover hay, but we reduced the average of the best cows down to eight pounds of grain and from that on down to four pounds.

A Delegate—How many pounds of clover hay would you give a cow?

Mr. Cobb—Six pounds at night, the last thing.

A Delegate—Did you ever fill a silo with corn stover?

Mr. Cobb—No, but I know people that have, with entire success. Of course it is not as palatable, and it is not as good as silage with the ear chopped, but it is very good food. Another thing I would like to caution you about. Professor Haecker made a statement in regard to planting corn thick That is all right, provided you have ideal corn weather and an ideal section of the country. But I lived in Wisconsin when a boy and my father had that thick corn idea in his head, and about two years out of five we would have a drouth strike that corn field with an immense crop started and it would be stunted and the consequence would be that we would get an immature, unpalatable, unprofitable crop from that field. In my experience in planting corn for silage, for twenty years, I have found that in this section of the country the best results we can get, for tonnage and altogether, is to plant about a bushel to five acres and drill it. We get more foliage on drilled corn than on hill corn. And that will make you the best feed. Up there on my farm in Warren county we planted sorghum that made twenty-two tons to the acre and it was so heavy on the ground that people declared as they went through the field in the day time, they saw fireflies between the rows. The chemical analysis of sorghum is lower in protein and higher in carbohydrates, and as to practical results, I am not in a position to say that one is better than the other. There is no danger in feeding, but I know that corn and sorghum, cut half and half and put into a silo, is more palatable and that cows eat it more freely than clear sorghum. If a cow likes anything, it is pretty good proof that it is good for her.

A Delegate—Can we safely go entirely by the chemical analysis in regard to foods?

Mr. Cobb—No, we can not, because we find some things that analyze all right but are not palatable.

A Delegate—Take this southern corn we used to plant here for ensilage—that grew fourteen and sixteen feet high. Don't you get more tons to the acre with that?

Mr. Cobb—We get a great amount of watery stuff with a very little nutriment in it. Down in the east I found a great many people planting that corn and they were dissatisfied with ensilage, but they didn't know why. I explained the matter to them. The ensilage was very sour and it lacked palatability and it lacked nutrition. But the tillable land is limited there and they wanted to produce the greatest tonnage. They were doing it that way. I was in Wisconsin this fall and they were doing that same thing there—trying to raise tons to the acre. I never believed it before in my life, although I have been told so, but actually they had drains in the bottom of the silos to drain off the excess of sap. That is a new feature but that is just exactly what some of those silos were fitted with.

Mr. Glover—Mr. Young has had some experience with that. What do you think about it, Mr. Young?

Mr. Young—Of course I never analyzed. I put it in for the bulk of it. I knew I was getting a very large yield per acre and there was no souring or extra fermenting of it as is sometimes claimed. But I let it get ears on, great big ears too. I cut it and let it wilt a little.

Mr. Glover—The point to make is that if that is developed to the same point that our common corn is it makes splendid fodder and lots of it to the acre and it makes more dry matter to the acre. But if we are looking after grain in our corn we don't want to plant it.

Mr. Cobb—Take that southern corn around here and we have got to take the risk of getting it to mature properly. If we do have to cut our ensilage a little immature, then to make a good grade of ensilage, it ought to be cut a day or two days ahead of the teams and let it get rid of a part of its surplus moisture.

A Delegate—Let me ask: If it is planted as thickly as Mr. Hecker spoke of, so that there are no ears, would or would not that fodder be pretty well matured before it was put in?

Mr. Cobb—Oh, yes, it ought to be allowed to ripen right up to the limit of moisture.

Mr. Glover—He determines that by investigating the condition of the lower leaves. When they begin to dry he puts it in.

A Delegate—I have another subject. I don't know that I am exactly safe in bringing this up. It is a question I never heard discussed, and if nobody here has ever had a cow lose a calf, perhaps you are not interested. But it is the question of abortion in herds. It is, perhaps, something none of you here ever had, but I have, and I would like to hear what the different dairymen here have to say on the way they handle it.

Mr. Cobb—I have been called to a good many herds in the last three years to start the right conditions to stamp out this disease. I was in Missouri three years ago and went through the state with the state veterinarian and he was talking of this matter. He said if people had abortion in their herds, to get rid of the herds because it was an incurable disease. We have all found that it is not an incurable disease. It can be stamped out But the ordinary help on the farm is not going to stamp it out. The greatest cause of its getting into your herd is through your bull. The farming out of your bull to your neighbors is one of the greatest sources. And using the bull without disinfecting from one animal to another is the way it strikes through the herd, as a general rule. The only thing we can do is to disinfect the cow before service and the bull as well, and by thoroughly disinfecting the barn as much as once a week anyway. In cases where I have taken charge of these herds I have used a compressed air spraying machine, a gallon spray or three gallons as the case may be, and use carbolic acid or creolin. I like creolin the best. Spray those animals at least once a week thoroughly and continue it as long as there is any danger, it is a good thing to do that all the time; that is, make a practice of doing that not less than once a month. Spray your barn and stalls and cows.

A Delegate—How would you go about it with a cow? Would you inject her?

Mr. Cobb—Yes sir, we do. Take about a 2 per cent solution of creolin. That is not as irritating as carbolic acid. There are a good many people that are feeding carbolic acid. I have never done that because I have never had occasion to. I have always checked the disease by these protective methods.

Mr. Glover—I might supplement what he has said in regard to abortion. When you have abortion in your herd you have a serious matter to contend with. I might say there are three kinds of abortion. The first is the contagious abortion, which is undoubtedly caused by a germ getting into the herd. Second; we call sympathetic abortion. One animal sees another cow abort and she goes and does likewise. Apparently there is something to that. And then cows abort by becoming hurt in some way—hooked or bunted. Of course the latter is not anything very serious. But, in any case the first thing to do when you have a case of abortion is to remove this animal from the rest of the cows to a stable by herself. There will be a discharge from the uterus for many weeks, especially if it is contagious abortion, and her uterus and vagina should be treated, I think, with bichloride of mercury, commonly called corrosive sublimate. Carbolic acid is not as good a disinfectant as it is generally supposed to be. The bichloride of mercury is a better disinfectant, although more poisonous. Take one part of bichloride of mercury or corrosive sublimate to 5,000 parts of water. Dissolve it in the water. The cow should be treated daily with this solution, using from four to five or seven to ten quarts of it a day. Take a syringe—a fountain syringe if you wish and thoroughly bathe the uterus and vagina with the solution. You will have to roll up your sleeve and use your hand to get the tube into the uterus. This washing should continue until there is no discharge. Do not breed the animal for some time after that—let her go a little bit longer than you wish.

Now, the bull. What are we going to do with the bull? Take the same solution and use two or three quarts for him. Take a bug syringe and take hold of the end of his sheath, insert the syringe and inject the solution; work it along with your hand, Do it after serving every cow. The barn where this cow has aborted should be whitewashed and you may use considerable carbolic acid in the whitewash. You should also use plenty of air slaked lime on the floors. If you are watching your herd, you may be able to prevent abortion or at least prevent it from passing from one to another. Several days before she aborts, there may be seen a discharge. We often see that clear mucous substance coming from the cow just before calving, but there is nothing dangerous about that; but the minute it turns red, look out! She switches her tail and infects the cows next to her and they pass it on to the next, and so it goes on through the herd. If you notice such a condition, the cow should be removed and given a chance to abort by herself. Remove all the bedding and put whitewash all over the floor with a considerable amount of carbolic acid in the mixture. By taking these precautions you will, perhaps, by being persistent for several years, get rid of it But if you are slack with it, one cow is able to infect the whole herd and your treatment will count for naught, unless you are very persistent about carrying out these suggestions.

A Delegate—What about any danger of using that carbolic acid about the barn, and its affecting the milk?

Mr. Glover—I don't think there will be any danger if a man is reasonably careful. There seem to be good results coming from a solution of carbolic acid being injected into a cow's neck, or feeding it in the grain. You can feed her, beginning with twenty drops a day, diluted to about a 2 per cent solution, I should think. And then you can increase that to about fifty or sixty drops a day, and we have good reports coming to us about feeding, and we have reports on the other hand, stating it does no good.

A Delegate—In case a cow does not get rid of the after-birth, what is the proper method? And will this same solution that you speak of be a good cleanser?

Mr. Glover—It would be a good cleanser. Authorities are somewhat divided on what to do with the after-birth. Some believe if it has not passed from the animal in thirty-six hours, it is better for a man to put on a rubber glove and remove it. Others claim that they lose more cows by doing that, for in many cases the uterus becomes infected and the cow dies from blood poisoning. Professor Haecker does not believe much in removing the after-birth by hand. Veterinarians do it a great deal; in any case this solution is a good disinfectant.

A Delegate—Is there any danger of destroying the life of the semen by disinfectant?

Mr. Glover—Undoubtedly there would be, if it should come in contact with it before it had fertilized the ovum.

A Delegate—I thought there would be a chance of it, if you do it previous to mating.

Mr. Glover—It must be done some time before copulation takes place. You don't want to use the bull immediately after he has been treated in this manner, and you would not want to have the cow served immediately after she had been treated. Have all discharges stopped and everything healed up before you have her served again. And you may have trouble after your cows abort in getting them with calf again.

A Delegate—Don't you think it is a bad thing for the average man to go into the uterus of a cow with any old thing?

Mr. Glover—Yes, sir, it is. It takes skill. The less you can do of that the better. But dairymen, the owners of herds, should have a chance to go to an agricultural school where this is taught—how to do those things—if they could go to our agricultural school for a week or two weeks, and be taught the proper methods of disinfecting an animal, it would be worth thousands of dollars to the dairymen of this State.

A Delegate—I have had abortions in a herd of ninety to 100 cows—eight abortions in December. They started up the second week in December and I had, I think, in December, nine or ten abortions, and I started using carbolic acid and carbolized salt. I took a pound of carbolic acid crystals and crushed them up with fifty pounds of salt and put a tablespoonful in the feed and sprayed them with a carbo-naptholeum solution—the whole herd twice a day—went right along behind the cows and sprayed them all. I mixed this carbolized salt in their feed, allowing a tablespoonful to each cow. Since I have started those operations I have not had an abortion. I did the same thing last winter and inside of three months every sign of it had disappeared and I did not have any more until this December. There must be some merit in the way I have handled those cases.

Mr. Glover—I am inclined to think there is merit in feeding carbolic acid the way you state.

A Delegate—The handling of a cow after she has aborted, and getting her to breed, is a very delicate proposition. A good many people, I think, suggest going into a cow too much. I would suggest that the best way is to get at them before they abort, is to get a list of the dates when each cow is due to calve, put it in plain view of every man that works about the barn and from the sixth month on. look out, for it is pretty hard to tell when they are going to abort; it is usually the middle of the month. After they abort, if they abort before you can get hold of them to get them away from the herd, have a barrel of slacked lime handy, or any good disinfectant. Do not try to disturb the bedding or litter, but just cover it deeply with lime and let it alone till you clean your stable. Do not go spreading that all around through your herd. Get your cow out, and inside of twelve or twenty-four hours get a warm solution of carbolic acid—at least that is what I have always used. I am going to try corrosive sublimate. Inject that cow every day for a week and gradually ease off to twice a week as long as there is any discharge. I have kept them away for sixty days and have generally sent them away to the butcher regardless of their condition. I think that is the surest.

Mr. Muir—I was called to a herd last week that was affected in this way and I inquired what preceded it and found that the man had been taking in his neighbor's cows. One of these cows happened to be infected in this way and that is the way it was introduced in his herd. Some years ago it broke out in a herd of sixty cows of mine and I looked around for the cause. There was a narrow passageway that was wide enough for a man to pass through, at the end of a row of cow stalls, and leading into the other part of the barn. It was a passageway intended for a man to pass through, but not supposed to be wide enough for cattle. There was some feed over in the other part, and some young stock would slip in and get through there, and some of the cows found it out, and would crowd through. And I found that one of the helpers had been very rough to the cattle, and five of them aborted; and I found out it started frequently with rough handling. But we want to be very careful, and separate those from the herd. If you get hold of it in time, you can stop it. But I have known it where it has run its course, where the men did not know what to do at the time. They were at a loss, and it became chronic, and I know there was a very fine herd destroyed that way.

A Delegate—Can you stop an animal, after you notice her start to abort?

Mr. Glover—No; it comes so quickly in many cases that you hardly know it.

Mr. Story—I was just going to mention that you use a 2 per cent solution of carbolic acid hypodermically, and in a very great many cases we have stopped it, after the vulva is swelled and the udder started to swell. I use a syringe full to three cows, and it is absolutely safe, as far as we have ever tried it, and we have a large herd, and use it all the time.

Mr. Glover—I might state my own experience. I worked for Professor Haecker a good many years, and once we had trouble with abortion and we started to feed twenty drops a day, and we boys gradually increased it to sixty and eighty. I did not dare tell him at the time, but since then I have told him. But we increased it to sixty drops a day, and with apparently good results. But on the other hand we get letters from people, stating that they haven't good results from it.

Mr. Henderson—I had a case just exactly that way, last year; just about a year ago now. And I think I got mine through a bull that I had bought. I used what they call zenolcum exclusively, and I didn't have to enter any of the cattle. I simply kept it in the barn, and I applied it every day. I sprayed my barn, and sprayed my cattle, especially behind, of course—but all over the barn, stable, sheds, and yards, and generally. And I haven't had a case for quite a while, now. Of course one thing that I thought helped me out, just as soon as I found it. I turned the bull right off; sold him. And I went for about three months before I put another one into the herd. And as I say, I didn't use any injection whatever. That would not effect the cow after she has started to abort. I had several of those abortions that had run full time, but still the calf was not developed to anything like near full size. Could you tell me anything that was the cause of that, apparently?

Mr. Glover—No, I do not believe I could.

Mr. Storm—I was wondering what you thought about putting in a large variety of sweet corn for a silo.

Mr. Glover—I cannot say very much from experience for sweet corn or sorghum; but reasoning from what I know about chemistry, both sweet corn and sorghum contain more sugar than corn. Sugar, during the fermentation, is converted into acetic acid, which makes your silage perhaps more sour than when common field corn is used. That is the objection I have to sweet corn and sorghum. We notice when we cut our corn a little bit green, it has more sugar in it at that time, and the fermentation is carried on perhaps more rapidly.

Mr. Story—I raise sweet corn and feed it dry, and I find that is far ahead of field corn. That is, an acre will go a great deal further. Of course it won't make as many tons of feed as the other, but the cattle will eat it so much cleaner, and it does so much better.

Mr. Glover—Evergreen sweet corn, as well as sorghum, is relished by cattle, and it makes a very good change.

Mr. Story—Popcorn I find does well. It is smaller, and plants thicker. I have used it several years. I plant that or sweet corn very thick.

Mr. Storm—If you take say twenty good cows, you can make a gain of one and a half to two cans of milk a day, by changing from field corn to sweet corn, and giving them the same amount. Why would it not be as much better in the silo as it is in the field?

Mr. Glover—It might be, but I was just reasoning from analogy.

A Delegate—I have tried sweet corn in the silo and I find it as you say. It is sour.

Mr. Glover—I have another question that I want to speak of and that is that corn stalk disease. Sometimes confounded with hemorrhagic septicemia. This disease is caused by the cows eating too much dried corn stalks. I presume this dried stuff going into their paunch and mixing with the water therein, causes it to swell up and therefore distress them. That is supposed to be the cause of the disease and a great many cattle are lost annually by dairy farmers that feed only dry corn stalks to their cattle.

A Delegate—I think that is impaction of the stomach. That is not corn disease, is it?

Mr. Glover—I presume impaction is a better name than corn stalk disease. You feed corn stover, which is corn stalks without the ears and invariably you will find cows having impaction; meaning that the cows have become costive and the only remedy is to give them an injection of water in the rectum and a dose of Epsom salts. I found cows in Illinois troubled with cornstalk disease and with impaction and the veterinary invariably gave Epsom salts. I would suggest to the owner that he feed a little oil meal in connection with the stover. Bran would help, and water and salt.

Mr. Wiggins—There is another side to that which I am afraid some men are liable to get confused on. That hemorrhagic septicaemia is supposed by the best veterinarians to be entirely a germ disease. Where the germs are raised and how infection takes place they do not know, but it is usually off of corn lands that have been left to stock. And the impaction and the corn stalk disease are confused with it. Very often it is hemorrhagic septicaemia, and there is no impaction. And a good many veterinarians say that hemorrhagic septicaemia and corn stalk disease are the same thing. Four years ago I lost some steers that had been taken off of grass land and put on to fodder corn. The first one I noticed that was off feed wouldn't eat a thing. He was just logy. In a half hour he was frothing at the mouth and chewing, and it was not long before he was down, and died in fearful agony. Invariably they will strike with all four feet. And in a post mortem on such a carcass you will find lesions of the blood vessels. There is hemorrhage all through the small viens. I had four die of that very same thing, inside of ten days. We held post mortems on all of them. That was in November, I believe. The year after that, in December, there were five calves that were in a new barn, on a low spot. We had cut into the side of a hill, and they were in box stalls on the north end, which was rather low. When we put up the brick there for the foundation, it was a little bit watery; boggy. Now, I had, I think, five cases in those two stalls, from calves that had been in those stalls, I suppose. We took them out of there, and had one or two cases after that, and that was all. Last July I put them back in there again. I had three more cases. In the fall I took out all that clay, and put in six inches of cinders and a cement floor, and I lost three more this winter, in the same stalls. Now, the State veterinarian, Dr. Tiffany, claims that that disease, invariably, with few exceptions, starts from low lying lands; that the germ is stronger in the feed that comes off from the low lying land, or that it has more effect, somehow or other. There are a good many veterinarians that don't believe that at all. And none of them knows anything about it. However, I know when I stopped feeding corn fodder off of a place that was a pond years ago, and drained out, after I stopped feeding that fodder, I had no more cases of it. And when I took these calves out of the low end of the barn, which was perfectly dry. Yet I have now calves ten feet away from those stalls, and I believe they will be all right, and always will be. But I believe if I put calves back in those two stalls where the ground orginally was low, I would have the same trouble over again. They die in fearful spasms, and very seldom any impaction. They die from a day to six weeks old, on whole milk, skim milk, or any kind of feed.

Mr. Glover—I was talking with Dr. Reynolds this last fall, and he expressed the same opinion—that they did not know very much about the disease.

GENERAL SESSION, UNIVERSALIST CHURCH, 7:30 P. M., FEB. 23.

A lecture illustrated with stereopticon by Prof. O. T. Bright, of Chicago, was the feature of the evening. Professor Bright was introduced by President Wyman. Nearly 100 pictures were shown upon the screen, some of which are reproduced and presented in connection with this report.

PROF. O. T. BRIGHT.

THE IMPROVEMENT OF THE FARMERS' SCHOOLS,

This great State of ours is constantly exploited from the platform in many respects, not only as to the richness of its soil, its varied productions, its countless manufactures, its great wealth and greater possibilities of wealth, but also as to its great men who have been so prominent in our national history. Of all its productions, however, to my mind the most important is its girls and boys. In the public schools of Illinois there have been in attendance today not far from 1,000,000 children. And this is an amazing thought. If you should place them in single file beginning at the Mississippi river and far enough apart so that they would not be fooling with each other in the march, at the time that the first one that passed you in Joliet had reached New York, the last would scarcely have left the river. Imagine such a procession wending its way to the schools of this State, and then recall that half of these children are in our farm schools. Half of the teachers in Illinois are engaged in teaching boys and girls that live upon the farms, and this makes the problem of the country schools an exceedingly important one. The man who can do one thing which in any way brings about the betterment of these country schools, renders a patriotic service that he may well be proud of. Many splendid things have been said about these schools and their improvement, at this institute, and I need not go over the same topics the second time, but I propose tonight to illustrate to you some of the things which have already been said and also to suggest means of improvement of the rural schools which have not thus far been suggested.

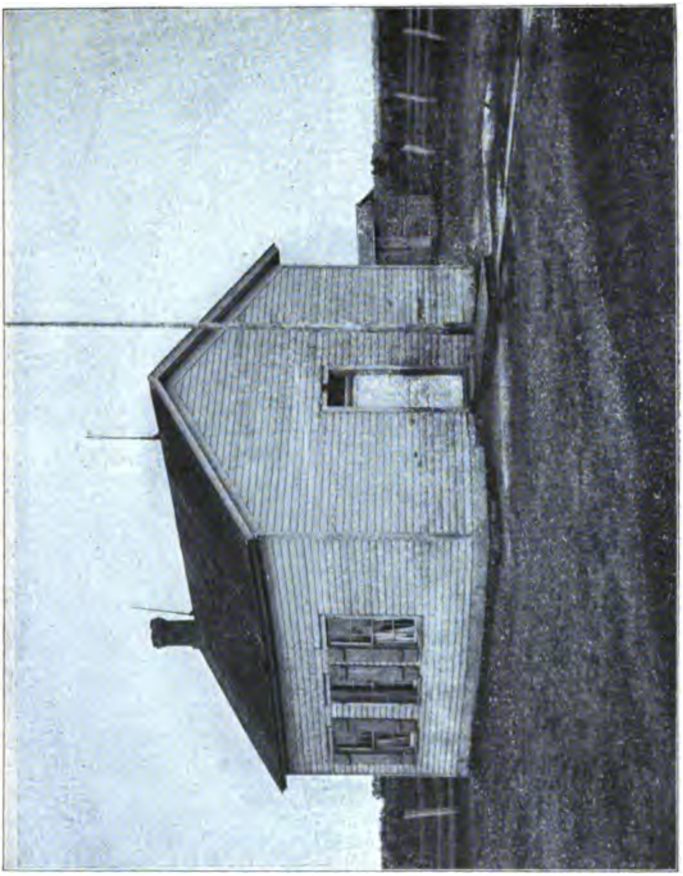
This great State of ours, 350 miles from north to south and 250 miles from east to west, is a State that we are all proud of. But I must say to you, my friends, in all sincerity, that when it comes to modern, up-to-date school legislation, the State of Illinois is a back number. As compared with Wisconsin, Minnesota, Michigan, Indiana or Kansas, so far as legislation is concerned, it is twenty-five years behind the times.

I have worked in almost every kind of public school that can be found in this country, but my keenest sympathies and special interest have been with the country school all of my years of service since I began boarding around in a country school district forty-five years ago last November. For eleven years, ending two years ago, I had charge of the schools of Cook county. The people in Joliet certainly know that Cook county is not all in the city of Chicago. There are 800 square miles not in the city limits and every one of the marks on the map which is before you represents a country school. Just such country schools as you have in Will county or in any other county of the State of Illinois. Of the 800 teachers under my supervision in Cook county, 150 were in the country schools. These schools are supported by farmers, and, so far as material surroundings are concerned, are like rural schools 100 miles from the great city of Chicago. There is one thing that I never failed to do in each of the eleven years that I was superintendent of Cook county—that was to drive my horse to each one of these 135 country schools at least once during the year. I have also worked in many other counties of the State, in teachers' institutes, and thus have kept in close touch with the farm schools not only in my own county, but in other parts of the State. I mention these things only to satisfy you of the credibility of the witness.

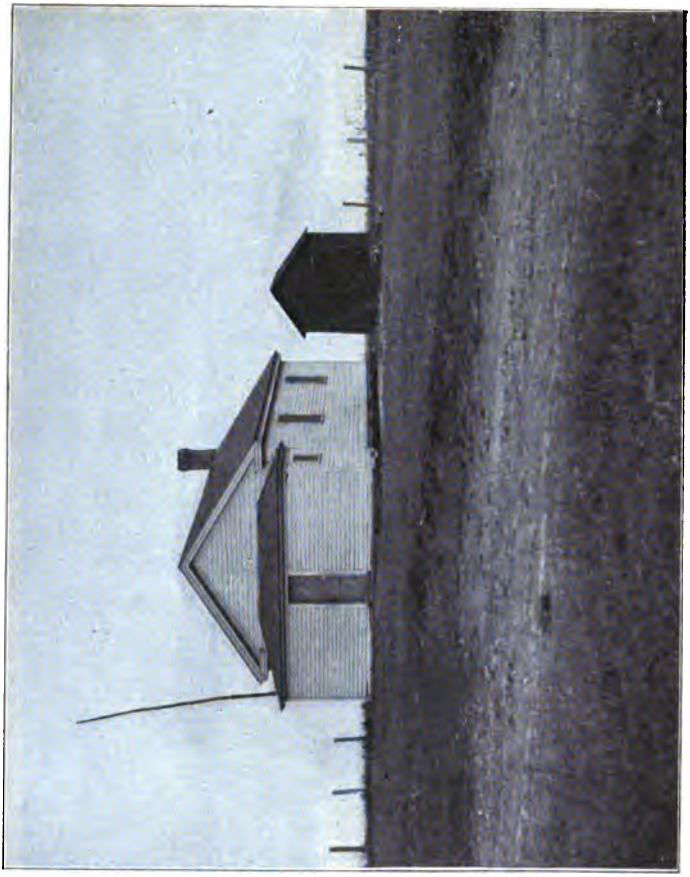
It is safe to say that there will be no revolution in the country schools of this State. Whatever improvement comes will come slowly, and perhaps this is well. I have, however, an abiding faith that some of the great measures which have made progress possible in neighboring states will come to Illinois sooner or later, although the vexatious delays caused by timid, scheming politicians who infest the legislature, are often very discouraging.

The first part of my lecture will have to do with conditions of which Mr. Harvey spoke so eloquently last night. I believe you will see many of his propositions more intensely after I get through, because there will be a massing of evidence by means of pictures which I shall show you upon the screen. There will be no sort of school house which you have not seen. There will be none so poor that you can not recall some like it in your own county, because, and I am sorry to say it, poor school houses are much more in evidence than good ones, in the school districts of Illinois. As I said before, there will be a massing of evidence and oftentimes the stereopticon picture impresses the beholder even more than the real thing.

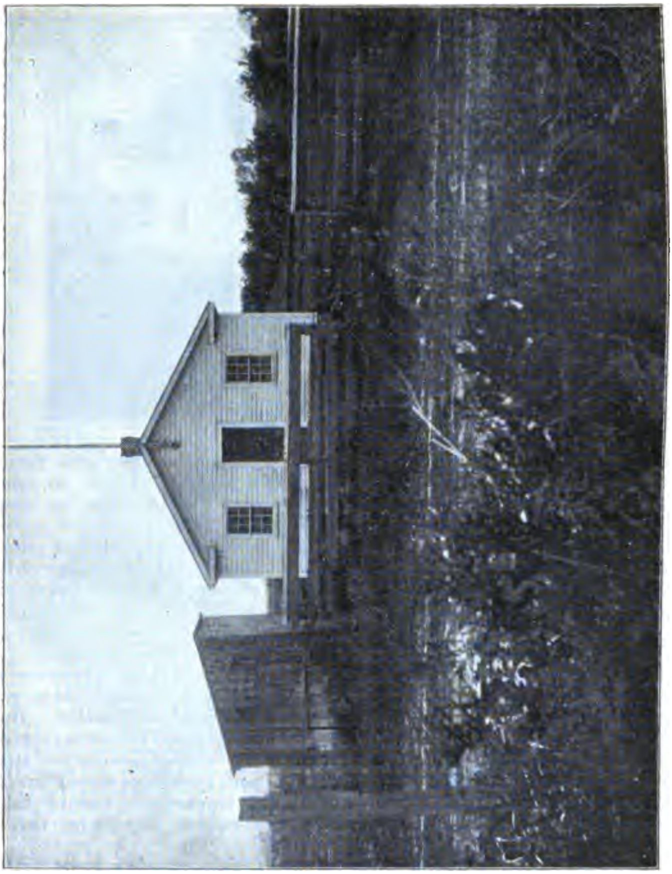
I shall show you only types of our rural schools, and they are types of things which are perpetuated only because of tradition—that is, we build this style of school house simply because our fathers and grandfathers built them. There is not an element of beauty in the building and nothing in the world to commend it except that it is a shelter. The trees which adorn this school premises are like those provided for nine out of ten farm schools the country over. This house has been standing for forty-five or fifty years within an hour's drive of the city limits of Chicago. A decade in a thing of this kind makes but slight difference and it makes no difference at all in the trees and other plants. As a type or style of architecture, the house shown upon the screen is the prevailing thing from one end of the United States to the other. I refer, of course, to its shape, which is exactly like a dry goods box with a roof over it.



Study the picture and see whether the description fits the object. There is just as much exercise of the gray matter of the brain in planning that sort of a thing as there is in planning a dog-kennel and no more. There is nobody present in this audience who has not seen hundreds of them. More than 50 per cent, yes, 75 per cent of the country schools in Cook county are of that pattern, so far as architecture is concerned. There is a little variation, here and there, as you see in the picture which follows and I wish to assure you that you are looking at the front end of this school house. It would seem as if this shed was placed on the front for the express purpose of adding to its ugliness. The children enter the school house through the shed every morning in thirty or forty school houses in Cook county and I entered it once a year in each of eleven years. The wood, the coal, the ash pail, the dust pan, the broom, the water pail, soap dish, wash basin (if they have one) and any old thing that is not wanted elsewhere, is in evidence as



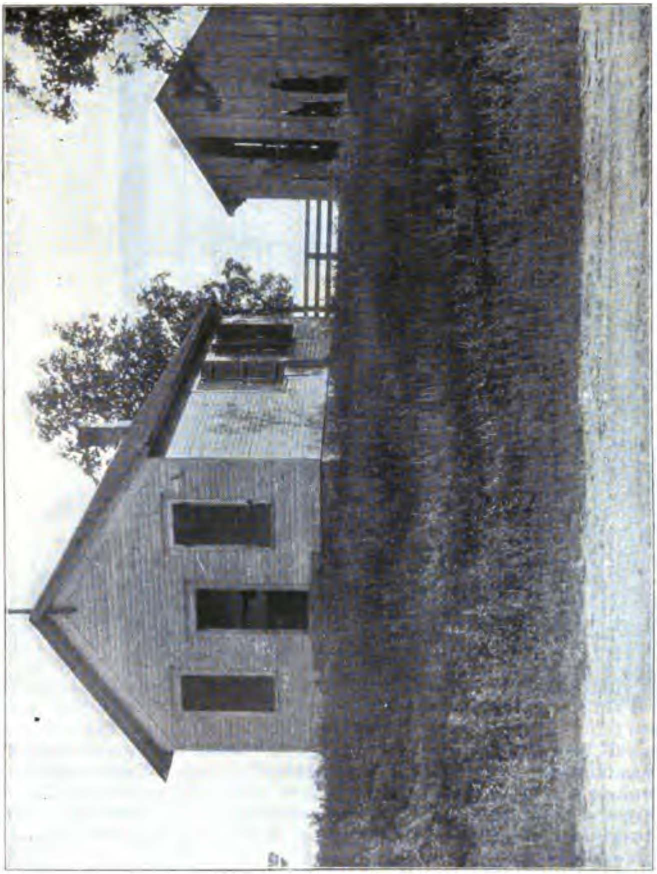
one enters the school house. What a pleasant reception each morning for the girls and boys from the farms who come to such a place to get their education. I contend that it is a ridiculous travesty on what we call patriotism, to set up a flag pole and fly the stars and strips over a concern like that which stands for all of the public education given to boys and girls in thousands and thousands of districts in every state in the United States. The training of children to holler for the flag and sing songs to it under such conditions is a hollow mockery.



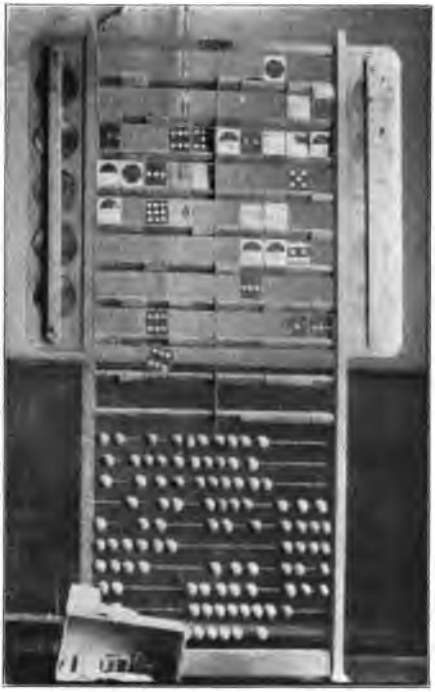
Here is another type, not in the shape of the school house, but in the general arrangement of buildings. The coal shed, the one outbuilding and the school house are bunched right together on the street and any farmer here knows where to go to find this lay out. The school house is about 14x18 feet and you see all of the buildings on the lot. I ask this question—how anything in the way of decency and modesty can be taught to children under such conditions as are provided by the farmers who send their children to such schools. There can be no excuse for such a thing in any district, and much less in a wealthy one such as these premises represent.

In almost any county in Illinois one may find many beautiful farm homes which, though they may be plain, simple and modest, show in themselves and their surroundings that some one with good taste lives in them—that somebody cares.

This home indicates that some one selected a site alongside of that group of fine oak trees, thinking, perhaps, it would be a good place for children to play. The same sentiment might dictate the choice of school sites, and why should not trees be alongside of the school house? I can not answer the question. It is one of the amazing things in American educational matters, that our country school premises are so barren, and God-forsaken. We find thousands of up-to-date barns in all parts of the State and wherever stock is to be cared for in these barns by progressive farmers we find them well ventilated, and this because they are provided for horses and cattle. But when it comes to school houses, where the children of these same farmers attend school, there is no ventilation whatever in the construction of the school house; and this, I imagine, because only boys and girls are cared for in these school houses, and in boys and girls there is no immediate return in dollars. In other words—we don't sell them. In many cases, like this, the ventila-

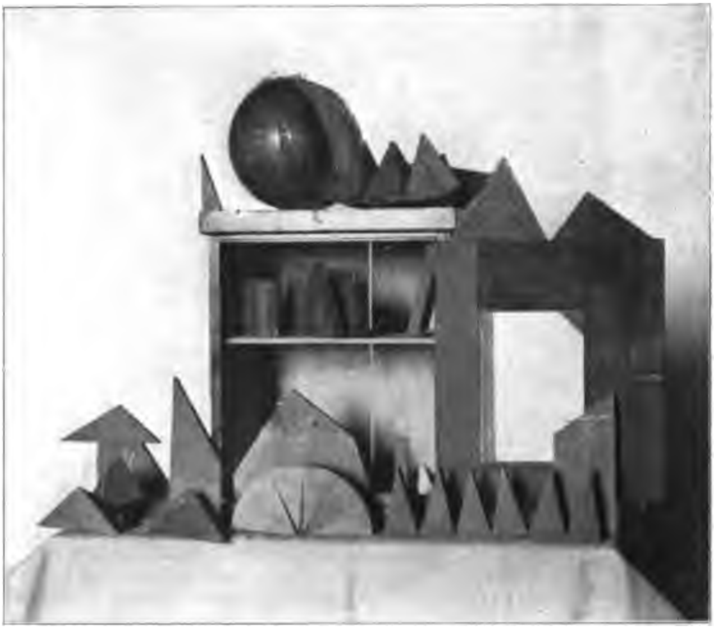


tion is all given to the coal shed. This particular school house has recently gone out of business, but for fifty years it was all that a wealthy district furnished for from forty to sixty children each year, and that within three miles of the city of Elgin. The school house stands on one-tenth of an acre of land and when it was built the land was not worth more than $29.00 an acre. In place of these school premises, a comfortable building has now been provided in a beautiful grove containing one acre of land. I believe that the change has been brought about as a result of publishing the picture at which you are now looking.



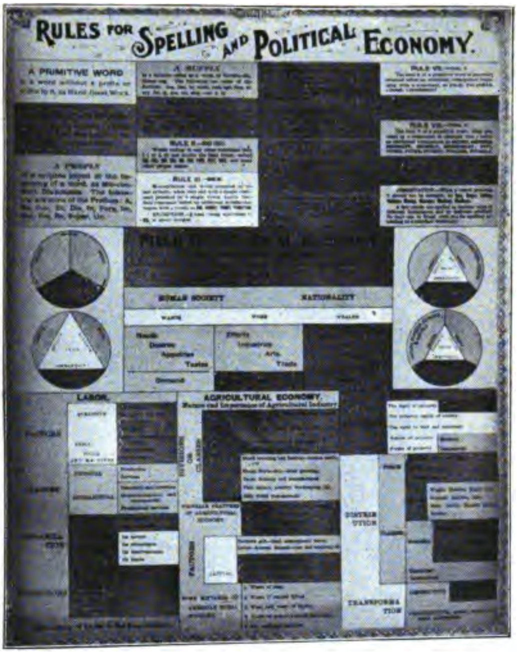
No. We do not have trees around our country school houses and the farmers are very loath to buy books which the teachers ask for and which are necessary in the teaching of their children. If the children are to be taught to read intelligently and quickly, there must be a good deal of reading matter for each year and especially for little children. Two years in a single reading book is a cruelty and it is the worst kind of economy. The farmers will not buy the supplementary reading books but they will buy things like this, and there is scarcely a country school in Illinois that has not indulged in this sort of wastefulness.

It is called school apparatus and is sold by traveling agents. It consists mostly of charts, but there are concerns of one form or another for teaching numbers. Enough money has been put into this so called apparatus by the

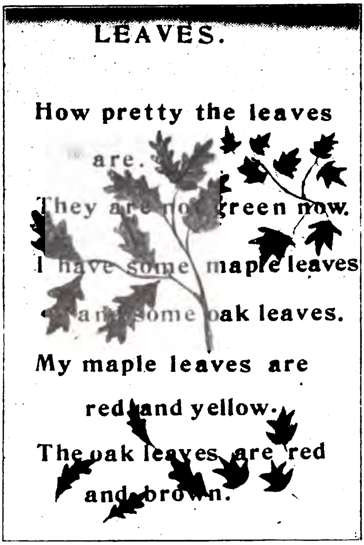


country school boards of Illinois to supply every school in the State with a good useful library and also to furnish a fair amount of supplementary reading books for the children. Most of the stuff bought by the directors is good for nothing, absolutely; it is rubbish which the teachers do not want. These so called geometrical solids can be found in thousands of the country schools of Illinois at from twenty-eight to forty dollars a set, paid for from the taxes.

I show you a single page from a chart containing fifty or sixty pages of similar stuff and which was sold for from thirty-five to forty-five dollars according to the gullibility of the directors. It was supposed to be a combination of all of the studies in a country school. I presume you have all heard more or less of the "correlation of studies" in modern teaching. This page may represent


RULES FOR SPELLING AND POLITICAL ECONOMY.
A PRIMITIVE WORD
A SUFFIX
A PREFIX
HUMAN SOCIETY
NATIONALITY
LABOR
AGRICULTURAL ECONOMY

something of the sort as you will see by the title "Rules for Spelling and Political Economy." Just think what $37.50, paid for this useless thing from the school tax, might have done for the children if put into the right kind of books. Charts may be very useful, but they will be such charts as are made by the teacher and the apparatus for making them with material for a year's use will cost only two or three dollars.

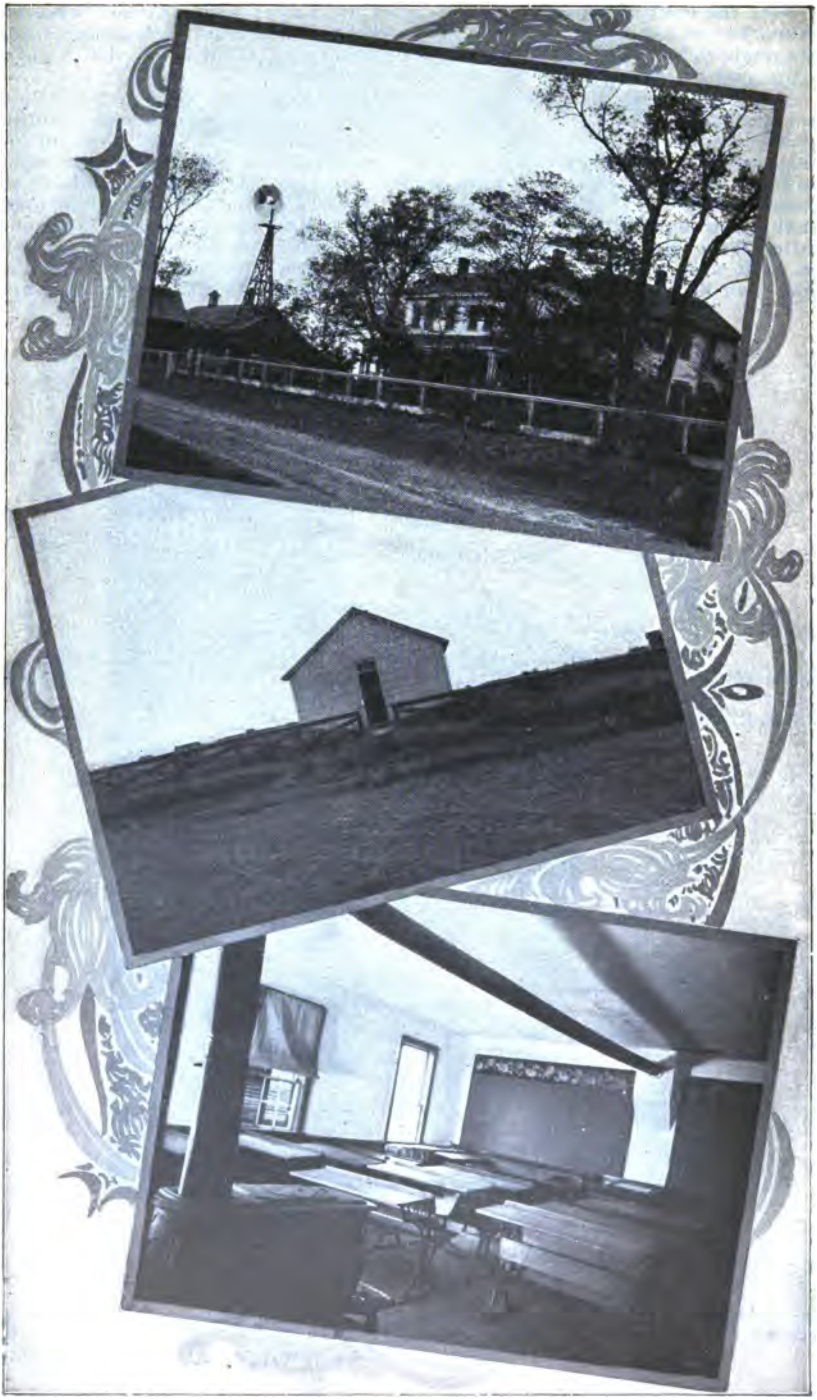


LEAVES.

How pretty the leaves
are.
They are not green now.
I have some maple leaves
and some oak leaves.
My maple leaves are
red and yellow.
The oak leaves are red
and brown.

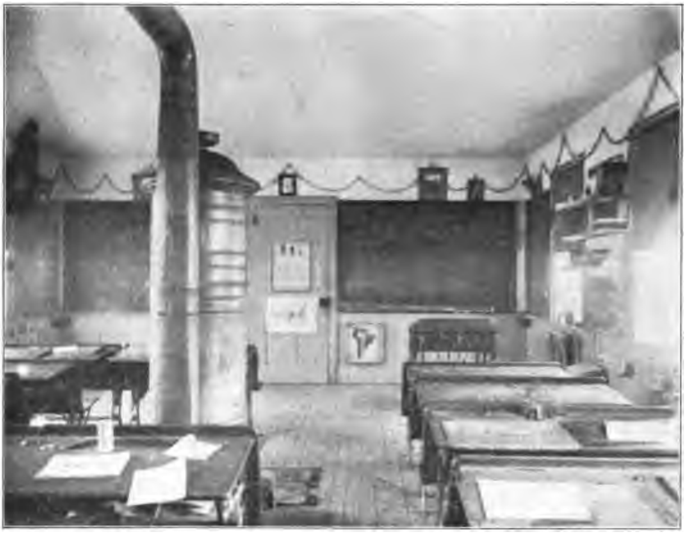
Note the reading lesson produced by a country school teacher who had taken her training in Colonel Parker's school. Such reading lessons as that are made to fit the topics which may be profitably studied in the country, suggested by the trees, the flowers and the birds.

As another type of school house of different material, notice this. There are plenty of forest trees near at hand, but they have all been carefully cleared from the school yard. You will note that there are windows on four sides of this house. There is no entry way, and the black board was about as large as an old fashioned handkerchief. I visited this school one cold day and found the air in the room stifling. I suggested opening a window, but found that storm sash had been tightly fitted and that the only provision for ventilation for a school of twenty or twenty-five children was two inch auger holes in each sash, and then for fear there might be too much fresh air, a little trap door had been made to fit over these auger holes. The sash had been

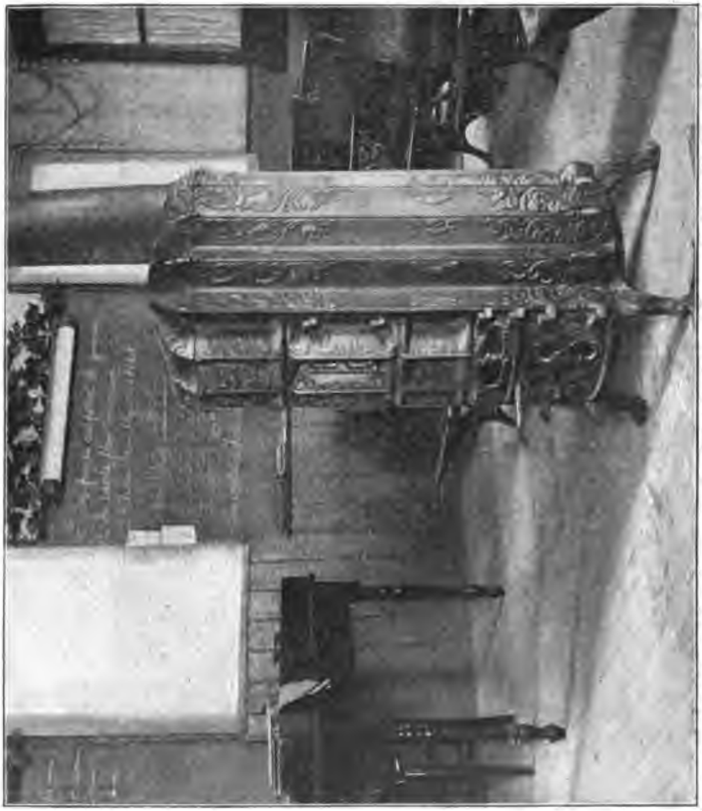


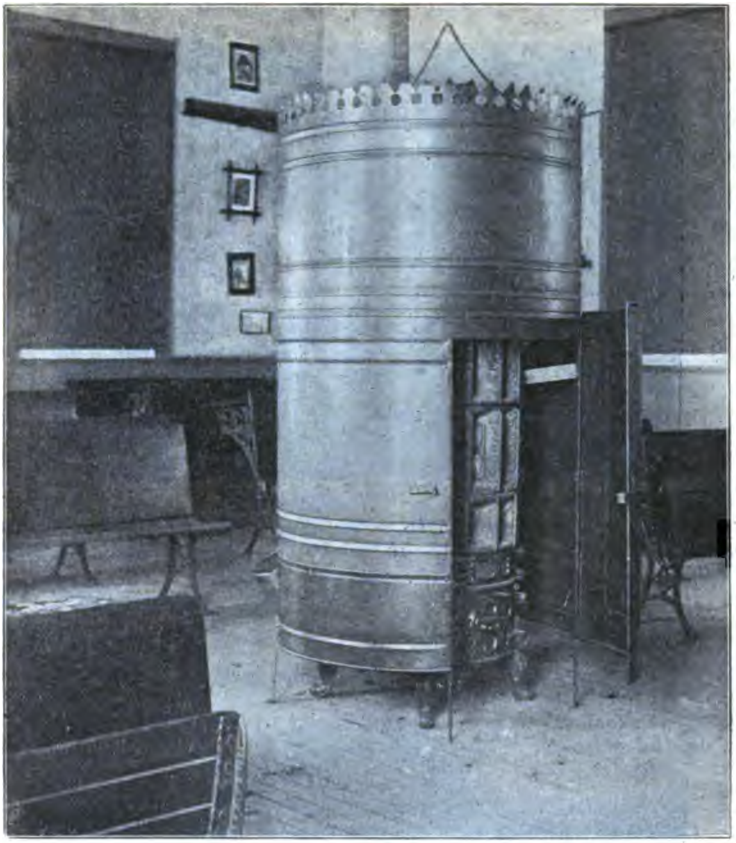
painted with the trap doors closed and they had stuck fast and the whole school house was pretty nearly air tight. The only possible ventilation was by opening the front door. Of course this sort of thing is the result of ignorance. The director who supplied the storm sash supposed he was doing a fine thing, but he did his job without consultation with anyone who knew. How much of disease and death comes to the children who attend country schools, through lack of knowledge of the ordinary laws of health, nobody can begin to estimate.

To illustrate this a little farther with a striking contrast between a home and a school house in the same district. Everything about this home shows good taste, thrift and care, hard work and saving. The old father of the present owner got his deed from the government, and the home is within a two hours drive of the city limits of the city of Chicago. Of course the first house has been replaced, but the third generation of children is now attending school in the school house which has never been replaced and is not likely to be and which is within two city blocks from the handsome farm home. The inside of the school house is quite in keeping with the outside. You see represented all of the seats except one row and this school house has as many as fifty children enrolled in a single winter, and that, year after year. You will note the stove of course, as it is the principal factor in the furniture of the school house, and this stove problem in country school houses is a very serious one. Heat it red hot in a cold day and the children near it are roasting while those who sit farthest away are freezing. Usually these stoves in country schools are placed in the center of the room and a large share of the room must be given up to them. Of course the center of the room is the best part of it. It is the part that should be most used. The majority of country school rooms are fairly represented, so far as arrangement goes, by this picture. Now, if anything could be more wasteful or extravagent than to give up a quarter or a third of the room in a school house to a stove, I should like to know what it is. This is done under the mistaken notion that the stove must be at the center of the room in order to heat it.



Here, again the mistake is made, because no thought is given to the subject. This stove was a heating terror, set between the teacher's desk and the desks of the children, which is a very common arrangement. After repeated requests that the room be properly arranged and the children protected from the stove, I finally offered to bear the expense of carrying out my suggestion if the results did not justify the change, and the directors consented. You will see at once from the picture what was asked for so far as the stove was

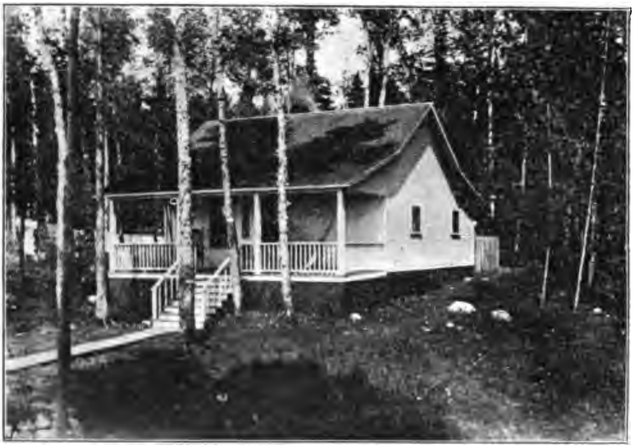




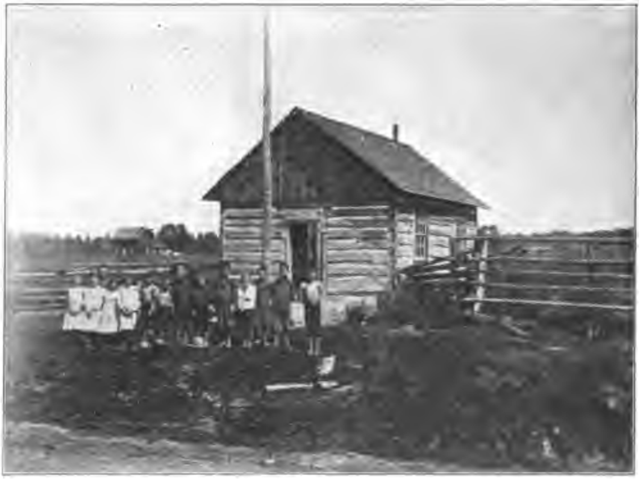
concerned. After the jacket was provided the stove was moved back into a corner where it belonged and the whole school room became available for school purposes. The entire expense of such a jacket is $6.00 or $8.00 and the school room was not only sufficiently heated, but was evenly heated in every part and one great danger to the health of the children was thereby removed. The children no longer suffered from cold feet and hot heads. Here is a chance for radical improvement in the old school houses.

Note another contrast and another type.

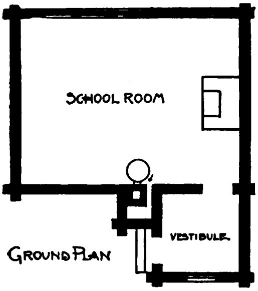
A friend of mine has this beautiful little home which he occupies in the summer months. It is not in Cook county and is not in Illinois. So far as the home is concerned, the point to notice is the care in saving the trees. The trees are cared for because the man has children and because the home

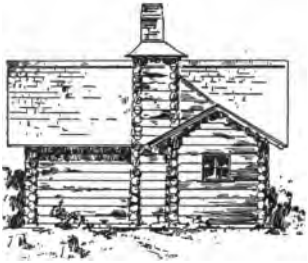


in which he is rearing them is so much pleasanter, so much healthier, so much more beautiful on account of the trees. Just eighty rods from this

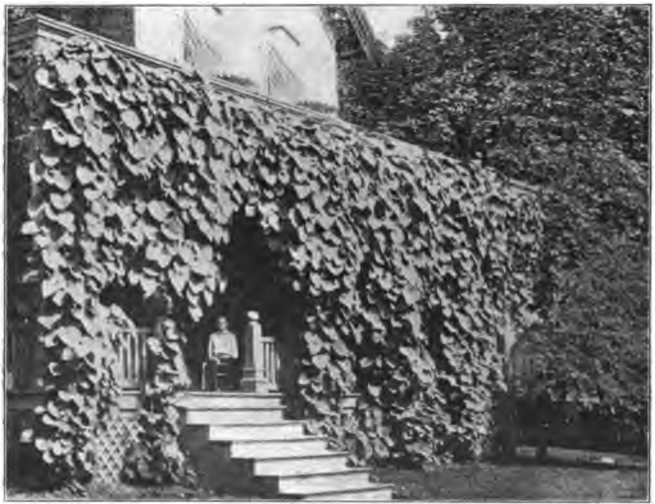


home is the school house of the district and it is a typical school house, rather extreme I will admit, but at the same time it is a type. You will note that the trees, and they were many, have all been carefully removed from the school vicinity. The entire land owned as part of the school premises is covered by school house, every square foot of it. The only playground is the street. There is not a building of any kind other than the school house. The land in the vicinity is not worth $20.00 an acre today. Is it not amazing that such a thing as this can be found today in a western state? Think of the health conditions imposed; think also of the conditions under which these children are coming to manhood and womanhood, and think also what is their notion of adequate educational provision in public schools, if such notion is learned in this school house. It is not because these people wish to impose damnable conditions upon their children, but it is because they do not think. In other words, "nobody cares."





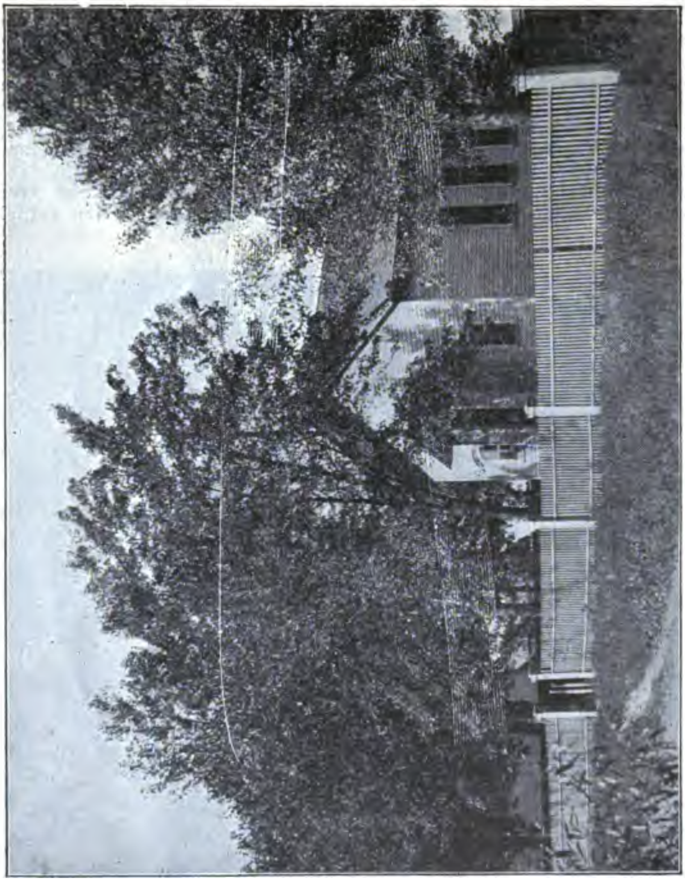
You may have a log school house and have a beauty, provided that brains are used in the construction. A little action of the gray matter may bring about such a building as this, that would be noted for its architectural taste. Note also the floor plan of the school with the stove, smoke flue and ventilator at the side and also that the smoke flue is made to cause effectiveness in the ventilator which is just alongside. Then if we should think to do



some planting to enhance the beauty of this building as is often done with the farm home buildings in the district, see what it might become. How many of you have ever seen vines growing upon a school house; how many have ever seen flowers blossoming alongside? Why not, I should like to ask? These things make the home more beautiful; they would make the school more beautiful. The same children that come from beautiful homes come to desolate school houses and why should they? Vines like these cost nothing but a little care and in the exercise of this care the children would be getting a better education, provided they cultivated the plants about the school house. Morning-glory and woodbine will grow almost anywhere, once well started, and the minimum of attention will keep them growing and make them thrifty. The exercise of care and the interest which makes growing plants healthful, develops character at the same time and that becomes beautiful as the plants become beautiful.

I insist upon it that the environment of the school house and its inside arrangement and decoration have vastly to do with the education of children. Beautiful surroundings at school will tend to beautiful surroundings at home. Tasteful arrangement of the school room, the tinting of the walls, the proper hanging of suitable pictures, all tend to an education that will sometime make beautiful and happy homes. A home must be something more than a shelter and a place in which to get food. It may be comfortable so far as freedom from bodily pain is concerned, but there is something else in the human being which must also have attention. Why have these trees? Because there is so much in them to teach and to interest. The opening of the buds in spring, their unfolding into leaves in the summer and in the fall the color that lends such beauty, and then the dropping of the leaves; and later in the winter, as you know, just about once a year, Jack Frost gets in his work at night when the moisture in the air is just right. What a fairy scene is presented in the morning when all the bushes and twigs are covered with millions of shining crystals.

You can have all these things for the children if you have the trees, but not otherwise. Nature study does not detract from the studies which have held in the school for all the years past. The teacher that can take the children out among the trees to study the wonderful work of the Creator, will not detract from the earnestness of the children in their ordinary lessons, but will add to it. This is the universal testimony. But if it were a little less of least common multiple, the greatest common divisor, or the capes and boundaries in Asia and Africa, and more of the study of things which are of immediate and continued interest around about where the children live, the education of these children would be vastly better than it is.



School houses are not all so forlorn and God-forsaken as those thus far shown, but the pretty school premises with trees, such as we see here, are the exception. This little building is very modest, but it is prettily surrounded and the whole effect is beautiful. I asked one of the directors:

"What did those trees cost?"

"I do not know what they cost."

"Did they all cost $50.00?"

"No."

"Did they cost $15.00?"

"No."

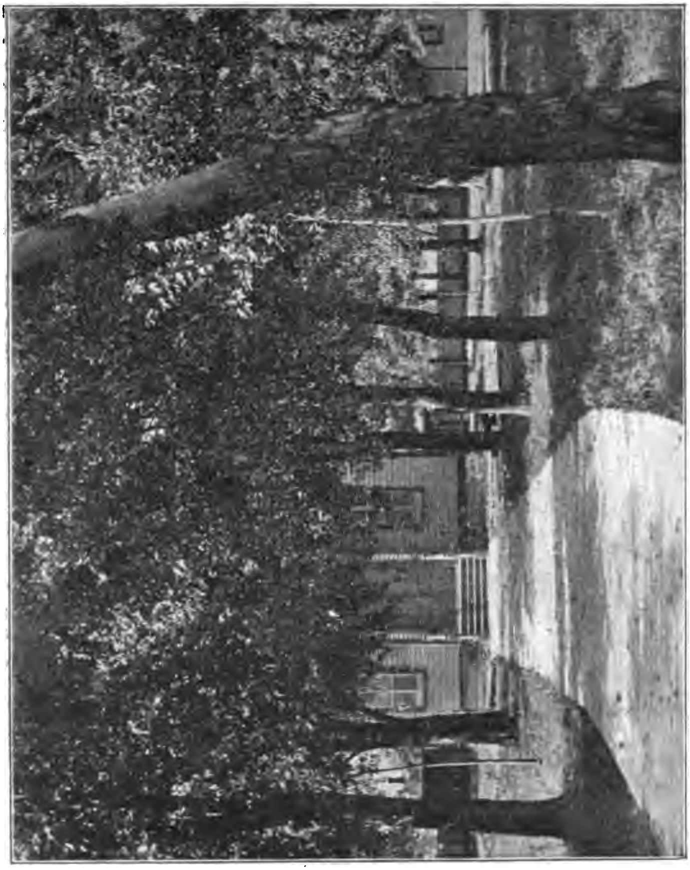
"Well, do you think they cost $5.00?"

"Well, I don't know. They may have cost $5.00. All there is of it, some of us got together one day a good many years ago and planted them."

"Would you take $50.00 apiece for them Mr. Wilson?" He answered:

"I guess we will keep them."

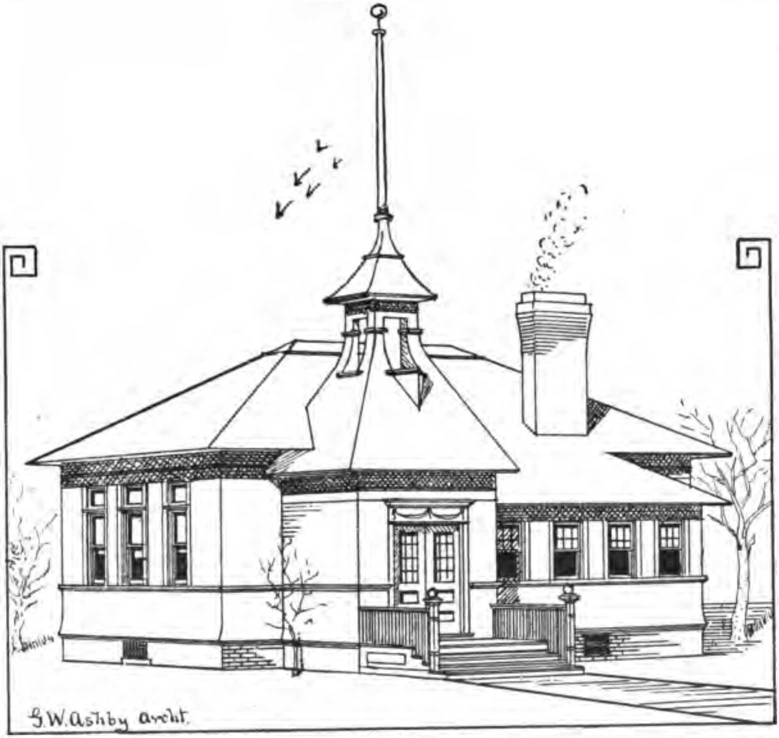
Would you keep them if they were around the school house where your children go to school?

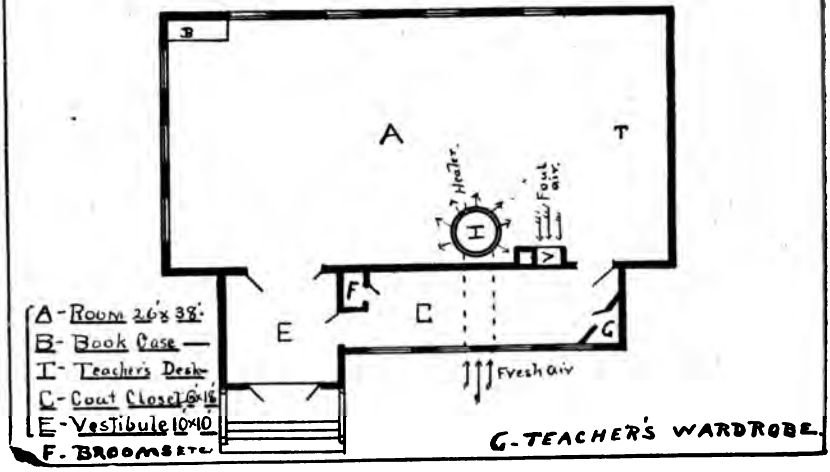


Do you suppose that children can go through this little avenue once a day during the school term for several years and not be the better for it?

This school is situated in a part of our country where the trees have come only from the planting, but someone thought to plant them and now the school yard is the greatest pride of every resident of the district. In all of the 135 country schools of Cook county, however, one can count all of the yards of this kind or that approach it, on his fingers. The same is true of 75 per cent of the counties of Illinois.

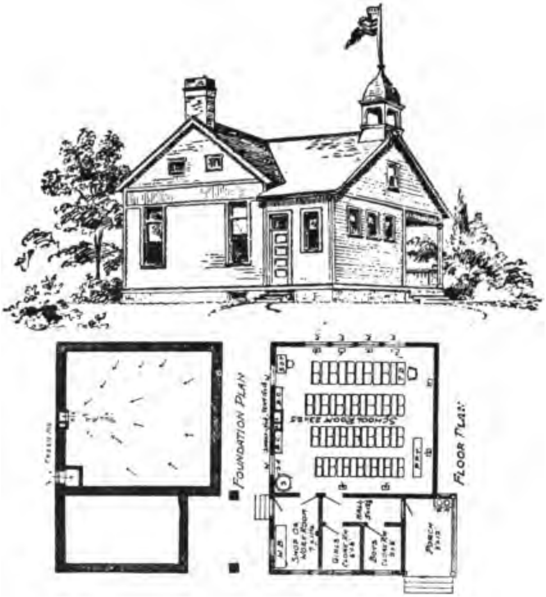
There is no excuse whatever for the sameness which has prevailed in the making of country school houses. The only thing to compare with it that I know of, are the homes in factory towns. In a township with six or eight or ten country schools, there should be the same variety in architecture that one would find in an equal number of pleasant country homes. To il-


G.W. Ashby archt.


B
A
T
Heater.
H
Foul air.
F
C
E
G
Fresh air
A - Room 26'x 38'
B - Book Case —
T - Teacher's Desk
C - Coat Closet 6'x 16'
E - Vestibule 10x10
F. BROOMS ETC
G - TEACHER'S WARDROBE.

lustrate what I mean, I ask your careful attention to the three pictures which follow and also to the floor plan of these school houses. They are all handsome buildings, but each is different from the other, as it should be. You will see how convenient school rooms can be made even in country school houses. Note that the heater is always placed out of the way where it will be least in evidence and that the ventilator and smoke flue are near to the heater as they should be. Very many of our present school rooms can be so arranged at a slight expense and be made almost as effective as the plans which I am showing you.

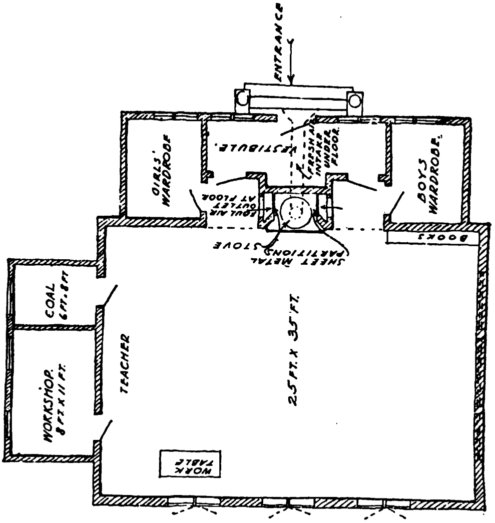
MISSOURI'S MODEL RURAL SCHOOL BUILDING.



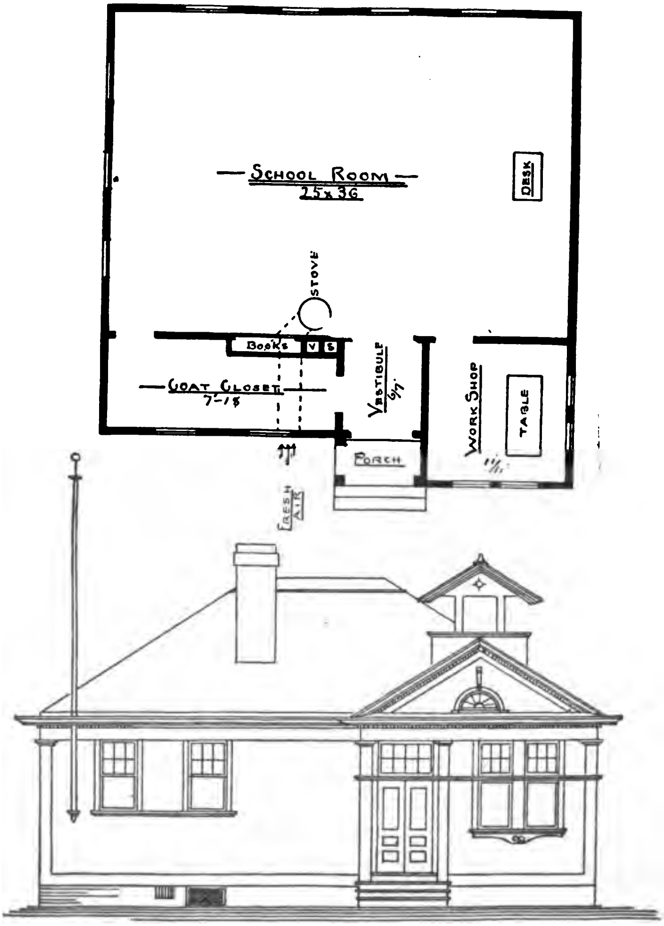
As an interesting feature of three of these plans, I wish you to note the work room, that is a room in which is a bench with tools, this may seem a great innovation, but it is an excellent one, for what better thing can a young farmer learn than how to use tools effectively? Note that the smoke flue and ventilator are always in conjunction. The reason for this, I think, will be evident to you, that the waste heat of the smoke flue shall cause the draft of foul air from the room, so that you see the ventilator is made effective without any additional expense. This sort of thing is brought about by thinking, and if a reasonable amount of thought had been given to our country school construction, the proper heating and ventilating would be the rule rather than the exception.

Here is a plan that was drawn at my suggestion by the present architect of the Chicago Board of Education, Mr. Dwight H. Perkins. For a single room building it seems to me pretty nearly ideal. Of course it may be varied to suit different taste, but be sure that the variation is to suit taste and not the lack of it. There is not one feature in the plan that is not essential. Notice that there are not cross lights and there should never be. The windows are on one side only. The work shop and coal room may be at the opposite end if you choose. The plan that follows is just about as good, though it has but one wardrobe. It was made by one of the best school architects in the State of Illinois, or in the United States for that matter.

After all is said and done the fact still remains that schools of five, six, eight or ten children can never be very effective schools. The condition of these schools was fully set forth in the masterly address which you listened



·PLAN·



G.W. ASHBY ARCHT.

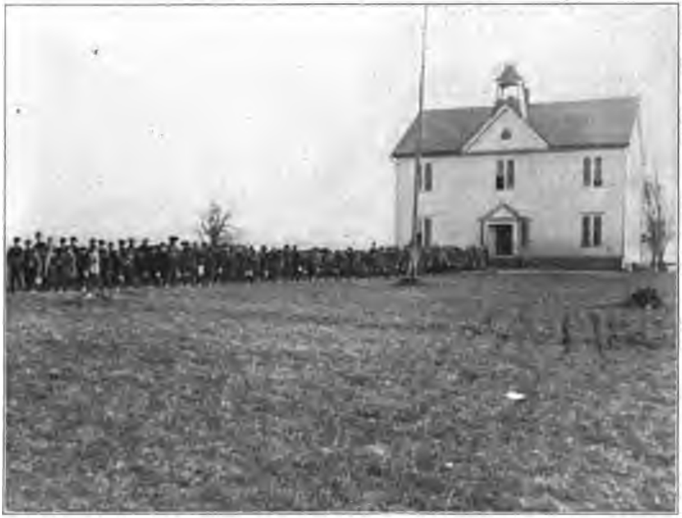
to last night from Dr. L. D. Harvey. He left nothing to be said upon the subject. The problem is up to the farmers as to what kind of schools they wish to support. That the little school house with its ungraded school was the school in which most of the farmers of Illinois got whatever education they have, is no argument for its continuance. The fathers of many of these farmers made their own shoes and some of them shod their own horses. Their mothers wove the cloth used in the family and knit the stockings. Most of these farmers did all of their riding as children in lumber wagons and many of them were drawn by oxen, but there is no argument in all of these facts for the continuance of such conditions. The farmer has no objec-

tion to a carriage or a surrey which has replaced the lumber wagon, and a spinning wheel or a loom, in a modern farm house would be a curiosity indeed. It may as well be conceded at once, that the splendid success wrought out by the farmers of Illinois is not because of the little ungraded school in the country school house, but in spite of it. It was the influences found upon the farm; the being trained to work and not to be afraid of it; the overcoming of difficulties which was accomplished in the company of the fathers and being constantly in the council of the fathers upon the farms—it is these things which have made possible the splendid success of Illinois farmers. The country schools have done their share and it is a splendid work which they have accomplished, but the same is true of the other pioneer institutions mentioned, but that they are the best schools for boys and girls of the farm is no more true than that they are the best schools for the boys and girls of the villages.

The last few years have demonstrated that a graded school may be set up and sustained among the farmers. Almost all of the northwestern states, and many of the eastern, have laws making the establishment of such schools a possibility, but there is no state in which their establishment has been made compulsory. For the past six years our splendid State Superintendent of Illinois, Alfred Bayliss, has been working incessently to have a law enacted by the Legislature which would allow any given community in the State of Illinois to consolidate its schools, establish a graded school and transport the children to and from school in wagons. Mind you that all that is asked is that the farmers be allowed to do this thing if they wish to do it. In other words that they may be allowed to give their children better opportunities for education through the expense of their own money, and this certainly does not seem an unreasonable request.

Certain religious influences have been brought to bear which have acted upon the timidity of the petty politicians who so largely make up the Illinois General Assemblies. One bill giving such permission was gotten through the legislature, but was vetoed by a weak executive. It is hard to understand why any organization, political or religious, can object to such permission. No argument has ever been brought against it and no valid argument against it is possible and even Illinois will sooner or later grant this boon to its girls and boys.

It was my privilege, two or three years ago, to visit certain consolidated schools in the state of Ohio. In one township, nine little schools had been closed and one graded school established in the center of the township. It was a purely rural community, no village or hamlet being found within it. The school has four rooms, the highest room being occupied by a high school class under a four years' course. The school house is a very plain affair as you see, and there is the same unaccountable absence of trees in the yard that one finds elsewhere. This is stranger in Ohio than in Illinois, because Ohio is pre-eminently noted for its magnificent trees. They could be found everywhere else in this township except about the school house.



Soon after I entered the school, which was upon a cold raw day in the latter part of November, the principal asked if we would like to see a fire drill, and within five minutes, all of the children in the school were ushered out upon the walk completely clothed in their wraps and with whatever else they would wish to carry home. Two or three minutes more found them back in their seats, but I had thus a chance to see the entire school together. The instructions in the school was most effective and I wish you to look into the faces of the children as they are thrown upon the screen.

The primary room contained children in the first and second reader, and there were about fifty of them. Just imagine fifty little farmers in one school room, all in the first and second reader. A brighter, more intelligent, and happier set of children I have never seen together. The second and third rooms had fewer children, perhaps forty in each, under equally favorable conditions.

I talked with the children in each room about their school; how they enjoyed the large school as compared with the small ones and also the coming and going. All were enthusiastic, after having tried the central school for

several years. The most remarkable, because the most unusual, feature of this school, was the high school room in which were thirty-five of the finest boys and girls that I have ever seen in a school house. They were doing high school work of such a character as to admit them, at graduation, to any college or university in Ohio and to many higher institutions in other states.

Now remember that every one of these girls and boys comes from his farm home in the morning and goes back at night to assist about the farm work. They are not taken away from home to the village at this most impressionable period of their lives, and not only do they enjoy the companionship of fathers and mothers in their own home, but they also make themselves useful as a part of the home institution, and any day in which there is a failure in their home duties, there is a partial failure in the home institution. This responsibility along with the good health that comes from the farm lives, gives them a splendid ability to work and "do things". I have yet to see elsewhere so keen appreciation of school privileges as I saw in this high school room.

And then comes to me the tremendous possibilities of this sort of school, situated among the farms, so vividly pointed out by Dr. Harvey last evening, and for which your superintendent Frank H. Hall is doing such splendid work. Scientific and intelligent farming may well form part of the course of study of rural schools. The schools could afford as principals the graduates of your State university and these boys and girls as pupils are sufficiently mature to appreciate the subject matter he would bring to them from its agricultural department and they would be intensely interested in this subject matter because it would have to do with their experiences on the farm. I think the most inspiring classes I have ever seen at work was composed of fifty or more farmers, ranging in age from one score years to three score and ten at a State Farmers' Institute at Rockford several years ago. The teacher was a young man from the State university. Every boy in the class had as subject for study, an ear of corn, and to say that he paid enthusiastic attention, but faintly states the case. I heard some of these same farmers say:

"The best thing about these institutes is, they make us think."

I was intensely interested, recently, in a chart of the cross-section of a kernel of corn, prepared at the State University and shown to me by Frank

Hall, and I thought of its developing power as matter for study as compared to the boundary of Nubia or the situation of the particular place where Cape Guardafui butts into the sea.

No other such richness could go into the farm school curriculum as a study of intelligent farming—provided that the teachers are up to it and the school conditions are such as to make it effective. The most powerful argument for this sort of thing is that fathers and mothers would have a vital interest in at least one study of their children and would study along with them. Imagine the impulse to school work that such an interest would give if it were at all general.

At the close of school, at my request, the nine wagons were drawn up in front of the school and all were loaded before any were driven away. Then with a waving of handkerchiefs and shouts of "Good-bye" they left us. It was one of the most inspiring experiences, this day in the consolidated school, that I have ever had and I only wish that the farmers here assembled with the thousands of other farmers in the State of Illinois, could see such an object lesson as I saw that day. There would be no question about what the next legislature would do in the granting of the privilege to establish similar institutions in this State.

If there is one thing more than another for which the politician lays his ear to the ground, it is to catch the voice of the farmer.

To show the effectiveness of the school in question, I wish to call attention to the following statistics of the week's attendance, for I was there on Friday. It might be the attendance of any week in the year. The table shows the entire enrollment, the membership of the school and the attendance on each day of the week:

Attendance of the Centralized Gustavus Township School, Ohio, for the week ending Nov. 22, 1901.

ROOM.	Enrollment.	ATTENDANCE.				
		Monday.	Tuesday.	Wednesday.	Thursday.	Friday.
1	58	55	55	56	55	54
2	41	40	41	39	40	41
3	27	24	25	27	27	26
4	36	35	33	33	35	35
Total......	162	154	154	155	157	156

On the black-board from which I copied this table I noticed the figure two out at the right and asked what it meant? The principal said that there had been two tardinesses during the week, an unusual number and he added, significantly, that the two children that were tardy lived just across the street from the school house.

The entire enumeration from six to twenty-one was 220. Of course this includes many who have finished school or were in higher schools.

The enrollment for the last year was 170. All of the children of the township from six to sixteen were attending school—absolutely all of them. Ohio has a compulsory school law, from six to sixteen which is observed. but these children needed no such law. It was attraction, not compulsion which brought them to school every day when they were well enough to attend. Just imagine 160 children from all parts of a township, going to school for an entire week and only two of them tardy. In the administration of this school, the drivers of the wagons are just as carefully selected as the teachers and they are placed under bonds. They must deliver the children at school by 8:45 each morning. The wagons are made perfectly comfortable through the use of curtains and robes, and in case of very severe weather even of heated soap-stones, so that the trips to and from school are made in comfort. I am often asked:

"Does it cost any more?"

Yes, it does, but it is worth more--by twice or thrice. Horses cost more than oxen, reapers more than cradles, watches more than hour glasses. The per capita cost is about one-quarter more.

The pleasure in this school, as in other social institutions, comes largely in the association of the members. The biggest thing in this world is friends and each child in the school knows all of the children in the township and calls them friends. You see how much bigger outlook the child has for social intercourse and pleasure, but there is something else comes to the children in the classes. A class of one or two or even three can have small inspiration, but a class of ten, twelve or fifteen is a very different proposition. Instruction in a well-conducted recitation comes as much from the children as from the teacher, provided the class is of adequate size, and this was the case with every class in this school.

The spending an hour or two hours on the road to and from school each day, tramping through mud and storms and deep snow, is not a profitable business. It may, in a certain way, develop strength, but not nearly so well as would a participation in useful work at home. Tramping on the road is a labor which counts for nothing. Cutting wood, washing dishes, caring for stock, sweeping and dusting the house and learning to cook, count for much. The physical strength of the children upon the farm may so easily and naturally be turned to some account. Besides there is no quarrelling and no chance for ill-practice on the way to and from school. But the best part of it all is that the boys and girls have associations with father and mother at the time of life when such association is most vital to them.

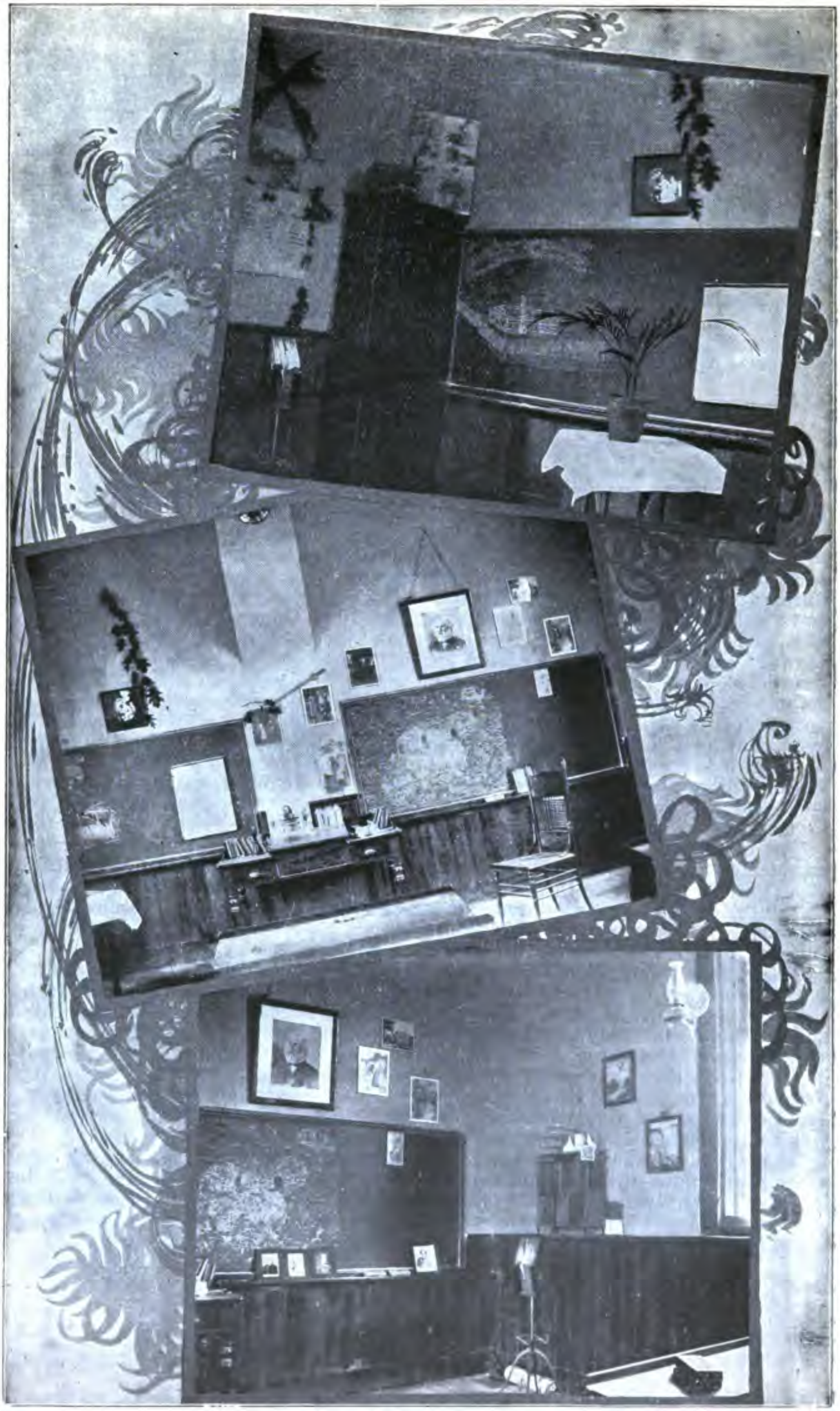
Oftentimes these same wagons are used in the evening to convey the parents to lectures or other meetings in the same school house where the children have been attending in the daytime. And this is one of the great possibilities of the centralized school. Is is not time that the farmers of Illinois should make a demand upon the legislature for the privilege of conducting their school affairs in any given township or community as they shall see fit, so long as they spend only their own money in doing so.

I thoroughly realize that the improvements suggested in these educational meetings of this farmers' institute must come slowly, that it will be many, many years before the best is reached, if it is ever reached, but each year must see marked improvements. The old school house must be made respectable and many of them may be made beautiful. The improvement of interiors through the intelligence and devotion of teachers during the past ten years have been amazing. The directors should meet them half way. Certainly the surroundings of every country school may be made beautiful simply through planting. I have insisted in this paper and I insist again that an appreciation of beauty is a necessary part of education. It is what makes happiness in this life if anything does. The school house must be made sanitary and this will be a matter of no great expense. This sanitation has to do with heating and ventilating; with the lighting and especially with the proper seating of the rooms. The walls of the school room should be tinted, not left blank white, or what is worse, decorated by the smoke from the stove, with here and there an addition from mischievous boys. We must have planting in the school yards, trees, flowers and climbing vines.

The most effective adjunct of any school, whether in village or country, in modern education, is the school garden. The garden at home is a very different affair from the school garden, because the latter is looked upon as a part of education, and how effective and beautiful a part it may be is known only to those who have tried it. There are tens of thousands of school gardens in Europe and almost none in the United States.

There must be supplementary reading and library books for home reading, and there must be pictures on the walls. Pictures which shall appeal to the experiences of the children, and they must be works of art. Such pictures are teachers and they teach right all the time. Then, with the trees and flowers about the school house will come the birds, the most beautiful creatures in God's creation; and they are not only beautiful, but they are vastly useful. I would have the girls and boys know that farming and gardening can not be carried on successfully without the aid of birds, and as part of their education I would train the children to love and protect them.

There is much that is possible in American education besides what we have been getting out of it. This finer side of education for which I plead will be the most effective means of making better citizens, and will promote that best of all desirable institutions in this country, the prosperous and happy farm home.



THE CLASSES.

On each day of the institute there were six morning classes, 9:00 to 10:15 o'clock, and one afternoon class, 4:00 to 5:00 o'clock. These classes for the most part were well attended. Such reports of this work as could be obtained are given on the following pages.

CLASS IN CORN—CLEMENT HALL.

Director E. E. Chester, Champaign, superintendent of class.
Prof. A. N. Hume, University of Illinois, instructor.

E. E. CHESTER.

THE USE OF THE SCORE CARD IN JUDGING CORN.

The score card in use at the present time by the Illinois Corn Growers Association consists of the following scale of points;

THE CORN SCORE CARD.

(Revised, January, 1905.)

1.	Trueness to type	10	9.	Kernel shape	5
2.	Uniformity of exhibit	5	10.	Length of ear	10
3.	Shape	10	11.	Circumference of ear	5
4.	Color	10	12.	Space between rows	5
5.	Seed condition	10	13.	Space between kernels at cob	5
6.	Tips	5	14.	Proportion—shelled corn to ear	10
7.	Butts	5			
8.	Kernel uniformity	5		Total	100

STANDARD MEASUREMENTS.

	Length.	Circumference.	Proportion—Per cent.
Reid's Yellow Dent	10-11	7¼-7¾	88
Leaming	10-11	7¼-7¾	88
White Superior	10-11	7¼-7¾	88
Boone county White	10-11	7½-8	88
Riley's Favorite	9-10	7-7½	90
Golden Eagle	9-10	7¼-7¾	90
Silver Mine	9-10	7-7½	90

GENERAL.

Northern Illinois	9.10	6¾-7¼	88
Central and Southern Illinois	10.11	7¼-7¾	88

In all exhibits made prior to Nov. 15 of each year, all standards of length and circumferences shall be increased one-half inch, and standards of per cent shall be reduced two.

A few preliminary remarks were given by the instructor concerning the utility of the score card. He stated that there is some analogy between a score card for judging corn and a score card for judging live stock. Whether we are ready to admit the fact or not, we must have a score card either in our mind or on paper when we engage in the judging of corn.

The question of which points are most important for our consideration is not so easy to determine.

One thing is certain, to be of any efficiency to the corn grower, our score card must contribute toward a greater yield of feeding value per acre at the least expense.

One of the important studies for experimenters in connection with this subject, is to find out the connection between the physical appearance of ears of corn and the ability of those ears to yield, if indeed there be such a connection.

If there be no such connection, then it will be well to make considerable changes in our present scale of points. It has always been held by the most sensible corn judges that we must make the score card fit the best corn and that it is impractical to try to make the best corn fit the score card when the latter is made arbitrary.

The fact seems to remain that the score card has been and will be of great utility in the selection of corn for seed, at least for the reason that it makes the ideas of corn growers all over the State and over the corn belt uniform.

We can feel practically certain that we raise better corn and more of it today than if we had never used a score card for judging.

The mere judging of corn by physical appearance has made corn growers and seed corn dealers and seed corn breeders more careful about their selections.

The score card has at least, called attention to a great many things that might not otherwise have been considered.

The points in the score card were spoken of separately by the instructor. Uniformity is important, if for no other reason, because it helps in a mechanical way to make our planters drop the desired number of kernels in every hill. In the present day, when we are using machinery, it is scarcely enough that the separate ear of seed corn be selected solely for high yielding capabilities. After these selections have been made, the matter of uniformity is still of considerable importance and corn which is uniform and high in yielding power is more valuable than corn which is just as high but not uniform.

The shape of ear is not a matter of such great importance, at least so far as we are now able to state, one variety naturally has a tapering ear and one has a cylindrical ears.

Color is important because it indicates purity. It may be that mixed kernels are as good for feed as those which are solid in color but they will not do for seed because it cannot be predicted what they will produce.

Market condition is a point which cannot be discarded from our score card because market condition means seed condition and if corn will not grow, it is valueless as seed.

The exact type of the tips and butts, which will be found on the highest yielding ear of corn has never been determined by experimentation, at least so far as has been recorded.

There is also room for experimentation upon whether kernels of any particular shape are most desirable. It would seem more or less evident that a wedge-shaped kernel with a very deep germ would have the greatest vitality but the instructor believes it is as yet impossible to make a very definite rule.

The part of the ear from which kernels are taken seems to bear little or no relation to their ability to produce. Results at the Ohio, New York, Kansas and Georgia stations substantiate this statement.

The reason for shelling off the butts and tips of ears and for discarding irregular kernels is a matter of getting a more uniform stand of corn because the irregular kernels will not drop uniformly from the planter.

Several samples of corn were brought into Clement Hall by farmers and corn growers. These were used as object lessons to illustrate the various points.

A good deal of interest was taken in discussion by those present and the actual scoring of the samples of corn.

RESULTS OF SOME EXPERIMENTS IN CORN GROWING.

It was stated by the instructor that while it is almost impossible to give general results of experiments that will fit all conditions, there are, however, some conclusions which may profitably be kept in mind.

It is absolutely necessary that any corn grower who expects to make a success of his season's work, have some definite ideas about what he expects to do, else his work will be accomplished at a great expense of time and with a good deal of misdirected effort.

Generally speaking, results have favored the shallow cultivation of corn as opposed to deep cultivation, and the depth of two inches would be understood as shallow cultivation.

Any kind of cultivation which injures the root system of the corn plant decreases the yield of corn. This has been partially demonstrated by comparison of root-pruned corn with corn having its roots undisturbed.

The practical application would be that corn should not be cultivated to a depth which would injure the roots, especially toward the latter part of the season when a greater proportion of the root system is near the surface than in the early part of the season.

Some experiments have been tried with relation to the number of times corn should be cultivated, and while there is still some more room for work along this line, it seems pretty clear that on our Illinois soils within the corn belt it is more profitable to cultivate three or four times than to cultivate a greater or less number of times.

The question was asked, whether the number of times to cultivate did not depend to a considerable extent upon the condition of the soil and the climate. These conditions do influence the amount of cultivation very largely.

The question is often asked as to what kind of cultivator is the best to use. Different kinds of cultivators are necessary under different conditions.

The question is frequently asked if, for instance, the surface cultivator or "gopher" is not the best, and it is necessary to answer that, while that might be best under many conditions, it cannot always be expected to do the work. It is very well adapted to cutting down certain kinds of weeds, but, of course, it does not stir the soil quite so thoroughly unless it is in very fine physical condition to start with. Probably two or more kinds of cultivators are necessary for use on most of our larger Illinois corn farms.

A weeder is ofttimes a desirable implement to use in corn cultivation. A weeder is a cultivator with long teeth, more like the teeth of a hay rake. These teeth will scratch surface soil but cannot be depended upon to stir the ground to any depth, and hence the weeder finds its place usually in the field before the corn is up or immediately after. It has been used, however, with good results, in some instances after the corn reaches considerable height.

The question was asked as to whether barren stalks in a field should be eradicated with a view to the breeding of a variety of corn which should always yield an ear on every stalk. It seems pretty well agreed upon by corn breeders that it is best in the breeding plot to remove barren stalks or to pull out their tassels, but from the standpoint of crop production in the larger fields with the view of getting a large yield in any particular year, this would not be necessary nor practical.

Barrenness seems to depend upon a good many factors aside from heredity, one of the principal ones being soil fertility.

Attention was again called to the assertion of Dean S. A. Forbes in his talk on insects, that an insect which injures the vitality of a stalk of corn may thereby render it impossible for that stalk to produce and ear.

Of course, the fact that good soil fertility and freedom from insects and plant diseases are essential to the production of ears, does not interfere with the fact that some stalks have greater natural tendency to produce ears than others, hence we should select seed corn from those stalks which are most prolific.

THE SELECTING AND TESTING OF CORN FOR SEED—THE GENEVA TESTER.

One of the most conveient devices for making germination tests is that commonly known as the Geneva Tester, so called because it was first used by Professor Goff at the Geneva station in New York. This apparatus consists of a water-tight box across which are extended folds of canton flannel. These folds are suspended from wires, and can be removed to dry when not in use. The box must be filled to the depth of about an inch with water, so that the folds of canton flannel will hang down enough to touch the water and thus be moistened by capillarity. The box should be about 12 by 24 inches and 4 or 5 inches deep. It may be made of wood, galvanized iron, tin or copper, and the wires can be cut from ordinary smooth galvanized fence wire. When kernels of corn are to be tested in this germinating apparatus they are placed between the folds, in regular order and the folds closed together. If it is thought best. the groups of kernels from the separate ears may be numbered with slips of paper. This numbering will not be absolutely necessary if proper care is used to have the groups of kernels correspond to the ears of corn from whence they came. After the kernels are put in place, the folds are drawn together at the top, the lid closed upon the box, and the apparatus left until the kernels germinate. When put into this box, the kernels will not usually suffer for moisture during the length of time of one test. This is one of the advantages of the Geneva tester over the plate of sand where the moisture may need renewing each day, or even oftener. The folds are easily opened when it is neceesary to inspect the kernels to count the number which have germinated. Some care is necessary in lifting the tester, that the groups of kernels be not jarred from their places.

TESTING WITH BOX AND BLOTTERS.

Another plan is to use a small box with layers of moistened blotting paper inside. This device consists first of a small box, say a foot long, six inches wide and five inches deep. The bottom of the box should be made watertight; if necessary, the cracks may be stopped with white lead or strips of cloth or asbestos. The kernels of corn are kept moist by putting water into the box to a depth of one-half inch more or less. Something must be laid in the box to hold the first blotter up out of the water. Small sticks laid crosswise of the box will answer this purpose.

The blotting papers should be moistened as they are placed in the box. When the first blotter is laid in. either small sticks or wire cloth are put down on top of it to mark the spaces for the separate groups of kernels. These spaces must correspond to the spaces in the frame where the ears of corn are placed. After one layer of blotting paper is covered with the kernels, another similar layer may be put down on top of the first, and so on until the box is filled, or until the desired amount of corn has been put in.

Like the plate and sand method and the wooden Geneva Tester, this device is easy to use on the ordinary farm because it does not necessitate the buying of any expensive apparatus or material. It would be possible to substitute any ordinary box which is reasonably close at the joints. Of course the wooden box will sometimes warp and begin to leak, making it somewhat difficult to keep the blotters from becoming too dry. Where it is desired to use a tester for any large amount of work, it is usually best to have the box made of copper.

TESTING WITH PLATES AND SAND.

One of the best and simplest ways of sprouting seed is to take a common dinner plate and fill it nearly full of sand. The sand should be as clean as possible. Such sand will be less likely to mould than that which has much organic matter in it. This makes it much more desirable for use in testing, for moulds interfere with the germination of the corn. After the sand is placed on the plate. it should be moistened. This can best be done with a small sprinkler, but if one is not at hand. the water may be poured carefully out of any small vessel or sprinkled with the hand. After sprinkling the water on the sand, it is well to mix the sand with the fingers until it is all equally moist. Do not saturate the sand with water. Special caution is necessary in this respect, for if the sand is too wet, the corn will fail to germinate for lack of air. Numerous failures have been reported in testing corn on plates of sand, the most of which probably resulted from having the sand too wet.

Having the sand properly placed and moistened, the kernels to be tested should be pressed into the sand, small end down, in the same order as they are taken from the ear. While taking the kernels from the ear, hold it in the left hand and remove with a pocket knife or a pair of small, strong tweezers, a kernel two inches from the butt of the ear. A little practice will make it easy to remove a kernel with the knife and hold it between the thumb and the knife blade until it is put in place in the sand. Then turn the ear one-fourth around and take another kernel in the same manner, say two inches nearer the tip; then turn the ear the same distance again and take another kernel two inches nearer the tip. For the fourth kernel, turn the ear again one-fourth around and take the kernel about two inches from the tip. Fou kernels is a large enough number to take from one ear for practical work If they are properly taken, they represent both ends and all sides of the ear so far as vitality is concerned. The four kernels from each ear must be placed in a separate group, and it is best that the group be marked or numbered to correspond with the number of the ear from whence the kernels were taken. For this plan it is necessary that the ears be placed in regular order, as the kernels are removed from them.

After the kernels of corn are all placed as described above, they should be covered by turning a second plate over them to prevent too rapid evaporation of the moisture from the sand. They may then be left in a warm temperature to sprout. As fast as the kernels are germinated, they should be removed from the sand, and a careful record taken of the number which have sprouted. It has been proved by experiment that the best temperature for germinating corn is 77 degrees Fahrenheit. This is only a little higher than the temperature of an ordinary living room. More harm will result from a considerable decrease in temperature than from a slight increase.

On the average farm it is not necessary to construct a special room for germinating. Usually the plates of corn will germinate well if put beside a stove, taking care that they do not get too hot. The plates must be inspected each day after they are put into the germinating room. and if the sand is becoming dry, add a little water. The amount to be put on must be determined by practice. for it will vary with the kind of sand used and with the humidity of the room. If one is fortunate enough to have furnace heat in the cellar, he will probably have a place near the furnace where the heat will be about right for germinating corn.

THE PRINCIPAL INSECTS INJURIOUS TO THE CORN PLANT.*

(By S. A. Forbes, State Entomologist.)

The Illinois State Entomologist is by law required to investigate "the entomology of Illinois," and particularly to study "the history of insects injurious to the products of the horticulturists and agriculturists of the State," and to prepare "reports of his researches and discoveries in entomology for publicaiton by the State." While the main end of his studies should thus be economic, the whole subject of the entomology of Illinois is nevertheless open to his investigation and report. The advancement of entomology as a science and the adaptation of entomological knowledge to educational uses, if not his duty, are clearly within the general field of his privilege. I have accordingly availed myself, in the preparation of this report, of the opportunity to incorporate into the present discussion much matter of little or no economic interest, but worthy of presentation, nevertheless, as material of value to the public school teacher in search of information concerning the commoner objects of his neighborhood.

The corn plant is so conspicuous a feature in the agriculture, and hence in the civilization of Illinois that it must always be an attractive subject of study to the youth of the State, and suitable in a multitude of cases for use in the public schools. Like most of the larger and more abundant plants, it draws to itself a considerable assemblage of insects which find in it various attractions and advantages contributing to their maintenance or their pleasure, and which thus, by their common interest in this one great plant, come to form a kind of associate group, the group of the *corn insects*. Very few of them are peculiar to the corn plant alone, since nearly all of them are equally or even more strongly attracted to other plants as well. Many of them, indeed, belong to a considerable number of such plant-insect groups, visiting or living on many other plant species, cultivated and wild.

Not one of them is immediately beneficial to the corn plant itself, although a considerable number, parasitic or predaceous on other insects, are indirectly beneficial to it by relieving it to some extent from the attacks of insect enemies. Several of them do no appreciable harm at any time; others are injurious only under special conditions more or less rare; and still others are injurious to it whenever and wherever they occur. Their common interest in this one plant of course brings these insects also into important relations to each other, like those which influence any local assemblage of animals—those of a pond, of a grove, or of a barnyard, for example—and make of them a related group instead of a mutually indifferent assemblage.

ADAPTATIONS AND REACTIONS OF THE CORN PLANT TO ITS INSECT VISITANTS.

There is little in the structure or the life history of the corn plant to suggest any special adaptation to its insect visitants—no lure to insects capable of service to it, or special apparatus of defense against those especially liable to injure it. The fertilization of its seed is fully provided for without reference to the agency of insects, and would be as well accomplished if none of them ever carried pollen from the tassel of one plant to the silk of another. Hence the plant secretes no honey and has no floral odor or colored bloom. It has no armature of spines or bristly hairs to embarrass the movements of insects over its surface or to defend against their attack the softer and more succulent foliage at its growing tip. It secretes no viscid fluids to entangle them, and forms no chemical poisons or distasteful compounds in its tissues to destroy or repel them. The cuticle of its leaf is neither hardened nor thickened by special deposits; its anthers are neither protected nor concealed;

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*This paper is composed of portions of the eighteenth and the twenty-third reports of the State Entomologist of Illinois—the seventh and the twelfth reports respectively of the present writer. The parts abstracted are printed essentially as originally published, except that some relatively unimportant matter has been condensed for this publication, and that a few of the articles have been revised in part to include results of our more recent investigations.

and its delicate styles—the silks at the tip of the ear—are as fully exposed as if they were the least essential of its organs. Minute sucking insects are able at all times to pierce its roots and its leaves with their flexible beaks, and with the single exception of its fruit there is no part of it which is not freely accessible at any time to any hungry enemy. Only the kernel, which was lightly covered in the wild corn plant by a single chaffy scale or glume, has become, in the long course of development, securely inclosed beneath a thick coat of husks, impenetrable by nearly all insects; and we may perhaps reasonably infer that among the possible injuries against which this conspicuous protective structure defends the soft young kernel those of insects are to be taken into account.

There are also, of course, many insect species, even among those which habitually frequent the plant, which are unable to appropriate certain parts of its substance to their use, but this is because of the absence of adaptation on their part and not because of any special defensive adaptation on the side of the plant. The adult or beetle of the corn root-worm (*Diabrotica longicornis*) is an example. The larva of this insect feeds only on the roots of corn, and the beetles consequently all make their first appearance for the year in corn fields and find their food at first on the corn plant. Owing, however, to the weakness of their jaws they are unable to eat the leaves of corn, and feed only on the fallen pollen and the young silks just growing out from the husks. Later, as the pollen disappears and the silk dries up, they are driven to other plants, or even compelled to leave the field entirely in search of food, and hence are found at that time on clover heads and on the flowers of thistles and ragweed and other late-blooming plants.

Thus we may say that with the exception of the ear the whole plant lies open and free to insect depredation and, that it is able to maintain itself in the midst of its entomological dependents only by virtue of its unusual power of vigorous, rapid, and superabundant growth. Like every other plant which is normally subject to a regular drain upon its substance from insect injury, it must grow a surplus necessary for no other purpose than to appease its enemies; and this, in a favorable season, the corn plant does with an energetic profusion unexampled among our cultivated plants. Insects, indeed, grow rapidly as a rule, but soon reach their full size. Many species multiply with great rapidity, but even these the corn plant will outgrow if given a fair chance, provided they are limited to corn itself for food.

The great injuries to corn by insects are done by species which come into it from other and earlier crops; insects which are in the full tide of their multiplication or perhaps at their maximum number for the season while the corn plant is still small and young. It is not the corn root-aphis which injures corn most seriously, although confined to the corn plant and endowed with a power of multiplication scarcely surpassed among insects; it is the chinch-bug, which breaks into the field of young corn from adjoining wheat or oats where it has already increased a hundred-fold since spring began; it is the army-worm or the cutworms or the wireworms or the white grubs, which began and got most of their growth in grass, and now, by their numbers and voracity, overwhelm the young corn before the time of its most rapid growth has arrived. Practically limited to this vigor of growth as a means of escape from insect attack, anything which checks or retards its growth for a considerable time has of course the effect to increase insect injury. Thus, a cold and backward spring after corn-planting increases injury to the seed and the young plant by wireworms, seed-corn maggots, and the corn root-aphis; and a midsummer drouth greatly increases the effect, if not the amount, of injury by chinch-bugs, white grubs, and the corn root-worm.

GENERAL EFFECTS OF INSECT INJURY.

With few exceptions, the effects of injury to corn by insects where they do not amount to a total destruction of the plant may be compared to the effects of simple starvation. Anything which lessens the store of food laid up in the corn kernel for use in germination and early growth, or damages seriously the roots or the leaves, or draws away the sap before it has served its purpose in the plant, practically amounts to a diminution of the available food supply. An impoverished soil, very dry weather, the sapping of the cells and vessels of the plant by sucking insects, destruction of any considerable part of its roots, and the deadening or destruction of any large percentage of its leafage, all have similar consequences which may be classed as starvation effects, and when two or more of them coincide, each serves of course to intensify the effects of the others.

One common result of these starvation injuries to corn is the failure of the plant to form the ear; the stalk itself perhaps making a fairly vigorous growth, but remaining barren and hence useless except for fodder. Injury to the roots if continuous and severe has, however, another effect of a more special character, in so weakening the hold of the plant on the earth that the stalk readily falls after it has become top-heavy with growth, and is not able to rise again. This happens after soaking rains have softened the ground, especially if accompanied by heavy winds. It is sometimes a consequence of the destruction of the roots by the corn root-worm and the white grubs, and is sometimes due to chinch-bugs which, by sucking the sap from the base of the stem, prevent the formation of the strong "brace-roots"—the upper circle of roots—put forth during the last stages of the growth of the stalk. Actual loss of roots sometimes also delays the development of the plant, acting in this respect like an unusually cool summer. Thus, a field infested by grubs or root-worms may remain green after uninjured fields are practically ripe. Such backward fields are especially exposed to injury by frosts, and hence are likely to yield an unusual amount of soft corn.

Besides this class of general injuries which diminish the vitality and lessen the size or delay the growth of the whole plant, there remain only the more local injury to the ear caused almost wholly by the caterpillar known as the corn root-worm, and the damage done to the ear in the crib or to the kernel in the bin by the weevils and other insects of similar habit. With respect to their economic mischief there is probably little to choose between those insects which, by destroying or weakening the plant, prevent the development of the ear or diminish its size and those which destroy the mature product. One deprives the farmer of the reward of his labors and investments as completely as the other.

GENERAL MEASURES OF PREVENTION AND REMEDY.

From what has been said above with respect to the starvation effect of most insect injuries, it follows that any management which helps to maintain and strengthen the plant by furnishing it better or more abundant food will lessen, or perhaps wholly prevent losses from insect injury which must otherwise be serious or complete. A strong, rich soil, well cultivated, well watered, and well drained, may grow a good crop notwithstanding an amount of infestation by chinch-bugs, root-lice, root-worms, and white grubs which would be fatal on poor or poorly managed land. The good corn farmer may thus escape with a profitable yield under insect attacks which will leave his less intelligent or less careful brother in debt after his crop is harvested. This is not merely because the vigorous plant will easily support an amount of injury under which the unthrifty one will suffer or succumb. It is an established fact that many insects themselves will not thrive as well or multiply as rapidly on a vigorous, quickly growing plant as on one in feeble condition.

More special measures are a proper rotation of crops, such that corn shall not be exposed to injury by insects which have bred on the same ground the preceding year, either in other crops or in corn itself; timely plowing to forestall the breeding of insects by destroying them or their food; timely planting, with reference to the period of the greatest abundance or greatest activity of certain species; and the use of barriers against the movement of certain destructive species into the corn from fields adjacent, combined with insecticide measures against hordes or companies of destructive insects, which if left to themselves will work great and immediate harm.

GENERAL INDICATIONS OF INJURY.

Before beginning a description of injuries to each part of the plant, a few practical hints may be given which will aid to a recognition of insect attack from the general aspect of the field or from the appearance of the entire plant.

1. If corn largely fails to appear in due time after planting, the farmer should not content himself with a surmise that his seed was poor or that the weather has been unfavorable, but should examine the seed itself for evidence of the work of one of several insects (wireworms, seed-corn maggots, grass maggots, etc.) attacking it in the earth.

2. If the young plants make an unequal start, some hills appearing earlier and growing more thriftily than others at the very first, the roots should be searched for the corn root-louse; and even those hills should be examined in which the corn has not yet come up, as this louse sometimes infests the sprouting plant before it appears above ground.

3. The abundant occurrence of ants in the corn field, sinking their burrows among the stalks of the hill, is evidence of the presence of the corn root-louse in their company.

4. If the growth of the corn is arrested or retarded in patches throughout the field, the leaves turning first yellow and then red, it is likely that the roots are infested by the same root-louse, to be discovered by carefully digging up the hill and picking or gently shaking off the earth to expose the roots at their origin.

An unequal growth may also be due to an unequal distribution in the field of white grubs or corn root-worms, whose injuries to the roots will stunt the young plants or kill many of them outright. If no insect enemy is found, the difficulty is quite likely to be due to a disease of unknown origin known as the root blight of corn, a discussion of which does not come within the scope of this article.

5. If single stalks or entire hills are killed or withered when a foot high or less, search should be made among the roots and on the stalk below the surface for the wireworms and the white grubs

6. If the corn falls readily in a windy storm and does not afterward rise, and if it may be pulled up easily after the ear has begun to form, it is probable that the roots are infested by the corn root-worms or that they have been eaten by white grubs. A severe drouth coming when the "brace-roots" are beginning to form may, by preventing their growth, produce a similar effect, independent of any insect injury.

7. If the plant remains green too long, maturing slowly, and if the field contains many sterile stalks or soft, imperfect nubbins, it is likely that the common corn root-worm, in some of its stages, will be found in or among the roots if search be made before Sept. 1. If large numbers of grass-green beetles one fifth of an inch in length (about the size of a common red ladybug) are seen on the silks and tassels of the corn, or feeding upon the fallen pollen collected at the bases of the leaves, or upon the blossoms of ragweed or other flowering plants in the field, the crop has suffered from an attack of the corn root-worm, of which these beetles are the adult, and the ground should be planted to some other crop the following year.

8. A deformed and unequal growth of the foliage, especially of that unfolding from the roll of leaves at the growing tip of the plant, with more or less irregular and ragged injury, when the corn is from one to two feet high, is often due to an attack by the first generation of the corn-worm, the second generation of which burrows in the kernels of the ear of corn during late summer and early fall.

9. On the other hand, the presence of elongate holes, placed side by side in an orderly manner, in short rows extending across the well-opened leaf, is commonly the mark of an injury done when the corn was smaller by the corn bill-bugs, several species of which will be described when injuries to the leaf are under discussion.

10. An irregular eating away of the leaves of young corn, and a similarly irregular gnawing of the stalk near the ground when the plant is less than a foot in height, should lead to an examination of the earth about the base of

the hill. If fine particles and small lumps of earth are found more or less closely webbed together in a mass approximately the size of a hickory nut, some one or more of the species of root web-worms are doubtless at work in the field.

11. The cutting of the young corn at or below the surface of the ground is an injury too well known as the work of the cutworms to require more than bare mention here.

12. The appearance in the side of the stalk of a hole about the size of a straw, with a brown moist powder exuding, is evidence of the presence of the stalk-borer, an insect which often does a great and practically irremediable damage to young corn in early spring, especially in low grounds, by burrowing the stalk, pushing more or less of its excrement out at the mouth of its burrow. The same striped caterpillar often enters the tip of the young corn plant, eating downward through the bases of the rolled leaves into the stalk—an injury to which it owes its common name of "heart-worm."

13. A similar, equally evident burrowing of the ear, the excrement from which escapes by a hole through the green husks or becomes mixed through the silks at the tip of the ear, betrays the presence of the corn-worm already mentioned under 8.

14. The eating away of the blade of the leaf in late summer and autumn so as to make large irregular holes, which may multiply and increase in size until they finally leave only the stripped midrib and the bare stalk—the injury being commonly very much worse along the edges of the field—is commonly due to grasshoppers.

15. In the corn crib or granary the commonest serious mischief is the peppering of the kernel with little round holes, each the diameter of the head of a pin, the first suspicion of which will frequently be aroused by the appearance of fine particles of meal sifting down somewhere within sight. The insect most likely to be responsible for this mischief is the corn-moth; but various weevil species may also be involved.

INSECT INJURIES TO DIFFERENT PARTS OF THE CORN PLANT.

To the Roots.—The most serious insect injuries to corn are done by the underground species, which, like the whitegrubs and the wireworms, may either gnaw and devour the roots; may burrow within them lengthwise. like the root-worms; or may simply drain them by sucking the sap through invisible punctures—a form of injury for which the corn root-louse is mainly responsible.

To the Leaves.—That the abundant, conspicuous, and easily accessible foliage of the corn plant should attract a large number of hungry insects and suffer more from their attentions than any other part, is naturally to be expected, since, as a consequence of its gradual and long-continued growth, it offers for consumption during many months the most succulent and nourishing food which the plant produces.

More than one hundred species of insects, representing all of the orders injurious to corn, have, in fact, been found feeding on the leaves. The most important differences in their injuries are due to differences in the mouthparts of the insects—whether sucking or biting—and the principal differences subordinate to these are due to differences in size, number, and feeding habits of the insects concerned.

A sucking insect, merely piercing the tissue with the delicate bristle-like structures of its beak and withdrawing from the adjacent parts the more fluid portions of the cell contents, may, if very small, drain and deaden only a few neighboring cells, thus causing a minute discolored speck, insignificant unless these injuries are very numerous. Such are the injuries done by leaf-hoppers and other minute sucking species of active habit, each deadened speck evidently representing a single meal of the insect, which moves to another point, or perhaps to another plant, for its next. Plant-lice, on the other hand, which change their location with difficulty and reluctance, each remaining, as a rule, about where it was born, accumulate in patches or colonies as they multiply, and, closely occupying a larger surface, so concentrate their injury as to do much more serious damage. If injuries of this sort are greatly multiplied, as by multitudes of the chinch-bugs, the whole leaf is killed outright.

Gnawing and biting insects differ similarly with respect to the magnitude and seriousness of their injuries. Some of the small size with feeble biting organs merely gnaw away the more superficial and softer parts of the leaf, leaving the vein structures untouched, and causing discolored specks not unlike those due to leaf-hoppers; somewhat larger kinds make small holes through the leaf like pin-pricks or shot-holes; and still larger ones, such as grasshoppers, eat away the edge of the leaf or gnaw large and irregular holes through it, avoiding nothing but the heavy midrib and the stronger veins. Grasshoppers sometimes strip the whole leaf to the midrib, and eat away all but the tougher and thicker part of this.

Curious parallel rows of precisely similar holes, running across the corn leaf, are made by the corn bill-bugs, which thrust their stiff snouts, or "bills," into the young plant where its leaves are rolled together, and eat out the interior by means of minute jaws borne at the tip of the snout.

To the Stalk.—The stalk of the plant is injured by the loss of sap drained away by sucking insects, of which the chinch-bug is the most destructive; by a mining of its interior by caterpillars, like the stalk-borers, which enter it from the outside; by the punctures and feedings of the corn bill-bugs, which sink their beaks into its substance and eat out its soft interior tissue; and by the gnawing of a few larger beetles (*Ligyrus*, *Allorhina*, etc.), which eat out large cavities in its side. It is similarly gnawed and irregularly eaten, when young, by sod web-worms; it is cut off at or near the ground by cutworms, and in rare instances by ants (*Pogonomyrmex barbatus*); and devoured, with the rest of the young plant, by army-worms and garden web-worms. Under ground it may be gnawed out or eaten through from side to side by wireworms, or irregularly mined by the small soft-bodied larva known as the southern corn root-worm (*Diabrotica 12-punctata*).

To the Ear.—Injuries to the ear are of two principal kinds: the kernels may be eaten beneath the husk by a large green or striped caterpillar which bores in from the outside and feeds irregularly about, fouling the ear with its excrement; or the silks may be gnawed away from the tip of the cob at a time to interfere with the process of fertilization, and thus to blight the kernel. Small damage is also done by various beetles, caterpillars, and grasshoppers, which gnaw away the kernels at the tip of the ear where these are exposed by the opening of the husks. This injury, however, is mainly confined to ears upon the ground or to those which have been previously visited by birds. Sometimes the husks are largely eaten away by grasshoppers, together with the softer parts of the young ear itself.

INJURIES TO CORN BY THE DIFFERENT ORDERS OF INSECTS.

Hymenoptera: Bees, Wasps, Ants, etc.—With the exception of a small bee (*Halictus lerouxii*) frequently seen gathering corn pollen from the silk, leaves, and husks, but responsible for neither injury nor benefit to the plant, various kinds of ants are the only insects of this order which occur frequently in fields of corn.

Ants are among the most active, observant, and capable of all insects. Their restless and wide-ranging habits bring them into acquaintance with every variety of objects in their neighborhood, and little escapes their notice or their appropriation which can in any way be converted to their support. The abundance of certain species in corn fields in spring, shown especially by their burrows in and near the hills of corn, is a matter of common observation. Even in fall after frost, or during the warmest days of an open winter, these enterprising rangers may be seen climbing over dead stalks or coursing irregularly about upon the bare earth; and many of them pass the winter in burrows or nests among the corn roots, where they are turned out in the spring-plowing with eggs and larvæ in their possession.

A few corn field ants are directly injurious to corn by hollowing out the softened and sprouting kernels in the earth, thus either preventing its germination, killing the young shoot, or weakening it by appropriating the stored food necessary to its earliest growth. The common house-ant has been once or twice reported to gnaw the young corn leaf and drink the sap exuding from the wounds thus made. One species of southern leaf-cutting ant bites out pieces of the corn leaf, which it carries away to its underground burrows, and certain other ants are found occasionally about the tips of the green ear feeding on kernels which have been injured previously by other insects or by birds.

Direct injuries of this class are, on the whole, economically insignificant, but a few kinds of ants are capable of an indirect injury to corn which often becomes extremely serious. By the care and assistance given to plant-lice, or aphides, which infest the roots and leaves of corn, they greatly extend and increase the injury done by these insects which they have in charge. This injury is mainly due to ants which live in corn fields throughout the year, reinforced as they are by newcomers from adjacent grass lands in early spring. In their underground nests in the field they collect in fall the eggs of the corn root-aphis, and in spring they place the young hatching from these eggs on the roots of suitable food plants. As these grow and multiply, the ants transfer them from one plant to another as necessity may arise, devoting themselves to their welfare with a constancy and patience, due not to charity, as it might seem, but to an enlightened regard for their own best interests. Throughout nearly the whole season, indeed, these ants are dependent on their helpless charges for food, which they find in the abundant fluids given off by the plant-lice as these suck the sap from the growing plant.

To the ant the plant-lice are living automatic pumps, constantly drawing from the tissues of the plant excessive quantities of sap, abstracting from this only a part of its food material as it passes through their bodies, and giving it forth again in condition to serve a second time for the support of insect life. A similar benefit is derived by other species of ants from the corn leaf-aphis, but this insect is only slightly injurious to corn, and the ants are less essential to it. Nothing is known, for example, to indicate that the eggs of the leaf-aphis are cared for by ants, and, indeed, no eggs of this species have ever been found.

With the exception, therefore, of the various species of ants which attend the corn root-louse in the earth, injuries to corn by these insects may be practically ignored as insignificant, and at worst as not serious enough to require or warrant attempts at measures of prevention.

Diptera: Flies and Gnats.—Among the multitudes of two-winged flies, or *Diptera*, only a few are found frequently on or about the corn plant, and scarcely one of these is likely to do it any serious injury. The winged insects themselves are never injurious to corn, all the harm done by these insects to this plant being through their larvæ or maggots only. When corn has followed upon clover, the roots of the young plant have rarely been injured by the large, dirty looking, grub-like larvæ of one or two of the crane-flies (*Tipulidæ*); the planted seed is sometimes eaten to some extent by the small seed-corn maggot (*Pegomyia fusciceps*); the leaves are occasionally mined in a very small way by two or three mining maggots (*Diastata* and *Ceratomyza dorsalis*); and the larva of a syrphus-fly, which commonly feeds on the fallen pollen lodged in the tassel or at the tip of the ear or at the base of the leaf, is reported sometimes to puncture the leaf for the sake of the sap. Other syrphus larvæ doubtless compensate fully for these small injuries by feeding on the corn leaf-aphis, of which they are very fond.

The sole measure of prevention suggested by these facts relates to the so-called meadow maggots, the tipulid larvæ mentioned above. These insects are found in injurious numbers only in meadow lands where they have hatched from eggs laid in grass or clover, and corn should not be planted on sod which was badly infested by these the preceding year.

Lepidoptera: Butterflies, Moths, and Caterpillars.—Caterpillars of about fifty-six species have been collected or reported from the corn plant, feeding on the stalk, the leaf, and the ear. or in some cases devouring the young plant entire. The principal injurious groups are the cutworms, the grass-worms, the army-worm, the web-worms, the stalk-borers, and the so-called corn-worm, which penetrates the husks and mines in the grain beneath. Of these, the cutworms, the army-worm, and the corn-worm are by far the most destructive. A few other caterpillars (*Hadena* and *Prodenia*), allied to the cutworms but having a different habit, are much less injurious.

Some seventeen species of cutworms have been taken in corn, all of similar habit with respect to corn, but very considerably different in life history—a fact which has an important bearing on measures for their control.

The stalk-borers, which penetrate the stalk and burrow within it, are the common species of that name (*Papaipema nitela*), the spindle-worm (*Achatodes zeæ*), the southern cornstalk-worm or sugar-cane-borer (*Diatræa saccharalis*), the smaller cornstalk-borer (*Elasmopalpus lignosellus*)—also essentially a southern species—and a caterpillar (*Helotropha reniformis*)—a northern species which does not injure corn in Illinois, but which has been known to destroy it in Michigan by burrowing along the center of the young stalk. In fact, only the common stalk-borer is commonly abundant enough in Illinois to rise to economic importance.

The grass-worm (*Laphygma frugiperda*) is a pest of common occurrence, but is ordinarily economically insignificant. Occasionally it multiplies in here and there a place in a way to cause serious mischief, although it has but once been found by us (in 1889) notably destructive to corn.

The army-worm does not breed in corn fields, and is rarely found there except when its numbers force it to migrate, but then it often lays the field absolutely bare by devouring every plant to the ground. The turf web-worms (*Crambus*) are sometimes very destructive locally in Illinois to young corn after grass, and the garden web-worms (*Loxostege*) are even more injurious in the west-central states. The corn-worm (*Heliothis armiger*), called also the cotton boll-worm in the South, is very generally and seriously injurious to corn in the ear.

The only groups of these caterpillars against which it is practicable or necessary to use special measures of protection in Illinois are the army-worm, the cutworms, the web-worms, and the stalk-borers, injuries by other species being either too trivial or too infrequent to warrant special precautions, or, like those of the corn-worm (*Heliothis armiger*), uncontrollable by any measures as yet devised and tested. Cutworms, web-worms, and stalk-borers may be virtually prevented from doing serious damage to corn by a proper arrangement and rotation of crops, and by an intelligent selection of times and methods of handling and plowing grass-lands previous to planting them to corn. The army-worm must be excluded from the field by barriers to its progress when it is on the march, and destroyed as it collects before such obstacles. A fuller discussion of these various measures will be found in connection with the special articles on the groups themselves.

Coleoptera: Beetles.—Approximately ninety species of beetles have been identified as corn insects in either the larval or adult stages, a few of them in both. Not more than one third of these species, however, need be mentioned in a merely economic list, and if we do not attempt to distinguish for economic purposes between the different kinds of white grubs and of wireworms which infest corn under ground, the list so reduced will contain less than a dozen names.

The habits of the adult beetle and those of its larva are in most cases so widely different that instances are few in which we find both stages of the same insect infesting corn, and there is not a single case known to me in which a *similar injury* is done to corn by both. The beetle larvæ injurious to corn all live under ground, and their injuries, consequently, are confined to the planted seed, the roots, and the underground part of the stalk. The adult beetles, on the other hand, may eat any part of the plant, from the seed and roots to the silk and kernels of the ear.

By far the most serious injuries due to beetles are done by their larvæ, especially by those known as wireworms, white grubs, and corn root-worms. The only injuries by the adults themselves deserving to be classed with these, are those due to the so-called bill-bugs of the genus *Sphenophorus*.

Beside these major enemies, whose attacks are largely preventable, there is a swarm of minor or occasional enemies against which it is both useless and needless to contend. Several of the ground-beetles (*Carabidæ*), for example, eat the kernel from the tip of the ear, and one small abundant species (*Agonoderus pallipes*) has occasionally done considerable harm by devouring the seed and the roots of the young plant.

Several small species of the family *Phalacridæ*, and others of the *Nitidulidæ*, similarly infest the ear, and the larva of one of them, *Ips 4-guttatus*, has once or twice been known to eat the planted seed. Two or three of the small dung-beetles and some of the leaf-chafers do similar injuries to the kernel on the ear or in the ground. A number of the latter group occasionally injure the young plant by devouring the leaves or eating into the stalks. Larvæ of two of the short-horned borers (*Prionus*) have been reported as rarely injurious to the roots of corn, and a considerable number of the plant-beetles, flea-beetles, and the like (*Chrysomelidæ*), are variously destructive to practically all parts of the plant.

The wireworms, white grubs, and bill-bugs are all primarily grass insects (the first and third much more strictly so, however, than the second), and their attacks, consequently, may be forestalled wholly or in great part by a proper management of the land with respect to rotation, and especially by using care in changing the crop from grass to corn. The corn root-worm, on the other hand, is a corn insect only, and its mischief may be promptly and completely arrested in any case arising, by planting corn on land not in that crop the preceding year.

Hemiptera: True Bugs.—Although not less than forty-five recognized species of bugs have been found sucking the sap from some part of the corn plant in the field, to say nothing of several others which have not been exactly identified, only one of this long list is a corn pest of the first class, but this (the chinch-bug) is, on the whole, by far the most destructive insect enemy of this plant in America.

The false chinch-bug (*Nysius angustatus*) has occasionally injured corn severely in our territory, making its way into the field from infested wheat adjoining, and the tarnished plant-bug (*Lygus pratensis*) has rarely been found responsible for noticeable injury. The corn root-aphis (*Aphis maidiradicis*) is capable of killing young corn by sucking the sap from its roots, but more frequently it merely retards the growth of the plant in spring, or perhaps permanently dwarfs it by this early drain on its vitality. The corn leaf-aphis (*Aphis maidis*) may kill some of the older leaves later in the season, but although it often continues to increase in numbers until frost checks its multiplication, it can rarely be said to diminish sensibly the amount or to impair the quality of the crop. Otherwise, the various sucking insects which are found on the corn plant obtain from the leaf, the stalk, the tassel, the silk, the husk, or sometimes from the soft young kernels exposed at the tip of the ear, an amount of liquid food too small to affect the growth of so vigorous a plant.

Special preventive measures are necessary or profitable, as a rule, only against the chinch-bug, and will be discussed in connection with that insect, although injuries by minor species may be reduced by clean culture, by the destruction of winter harborage for insects, and by a few other general measures characteristic of intelligent and careful agriculture.

Orthoptera: Grasshoppers, Locusts, and Crickets.—About twenty-five species of *Orthoptera* have been noticed as common in corn fields, the larger number and the only destructive species belonging to the so-called short-horned grasshoppers (*Acrididæ*). Like very many other insect visitants to the corn field, these *Acrididæ* are normal grass insects and go into the corn in numbers sufficient to attract attention only when their usual food threatens to fail, and their injuries are consequently confined at first to the edges of fields adjoining pastures and meadows. The great migrating grasshopper of the western plains is of course an exception to this statement, and an occasional migrant swarm of certain Illinois species imitates with some success the practices of this western insect, settling upon a field like a flock of birds and doing a general injury.

The ordinary grasshopper attack on corn is rarely made by the young, and is consequently postponed, as a rule, until late summer or early fall, when the corn is practically full grown and the insects are able to fly. Where the injury is severe the leaves are eaten away to the tough midrib, the husks are gnawed from the ear, and the latter, if still young, is itself devoured, little but bare stalks remaining about the edges of the fields. Fourteen species of short-horned grasshoppers are on our list of those injuring corn in this way.

The long-horned grasshoppers (*Locustidæ*), including the meadow grasshoppers, climbing crickets and the like, are not uncommon in corn fields, but they are only slightly injurious to that plant. One of them, *Orchelimum vulgare*, has occasionally been seen to eat the leaves, silk, husks and grain, and many other species sometimes gnaw away a few kernels from the tip of the ear. Several kinds of these insects frequently lay their eggs in the slender part of the cornstalk, in or below the tassel of the ripened plant, but their food consists mainly of pollen, fungi, plant-lice, etc., and indicates no injury to corn.

Two of the common crickets (*Gryllus pennsylvanicus* and *Nemobius fasciatus*) sometimes injure the ripened ear, especially where there are many fallen stalks in the field, by creeping in beneath the husks and gnawing off the surfaces of the kernels.

The only possible protection to corn against grasshoppers is the destruction of these insects before they leave the grass-lands adjoining or when they first enter the corn field. Once generally distributed in the fields, practically nothing can be done to arrest the injury. For their destruction in pastures and meadows, some one of the methods must be chosen which has been found effective against these insects in the West. These are, generally speaking, the plowing in fall of ground heavily stocked with grasshoppers' eggs, or plowing even in summer for the destruction of the young, the burning over of grass-lands after the young have hatched, the collection of the egg masses where these have been abundantly deposited, poisoning heavily the outer rows of corn with arsenic or Paris green, distributing along the edges of the field quantities of poisoned horse-droppings, the so-called Criddle mixture, and catching the insects in meadows and pastures by the use of the "hopper-dozer." The most important of these procedures will be more fully discussed on another page.

Neuroptera: Dragon-flies, Lace-wings, etc.—No insect injurious to corn belongs to the order *Neuroptera*, which, in fact, need be mentioned in this connection only to say that the occasional abundance in corn fields of the delicate and interesting lace-wing fly (*Chrysopa*) is to be connected with the occurrence of plant-lice there, upon which both larval and adult lace-wings feed. The winged insects we have found in corn fields eating the spores of fungi, the surface hairs of the leaf, and other delicate vegetable tissues.

Acari: Mites.—The mites commonly known as the red spiders (*Tetranychus bimaculatus* and *T. modestus*) have rarely been found injurious to the young corn leaf, causing a rusty or brownish discoloration. This injury to corn seems to have been too rare, however, to be worthy of special attention, although the wide-spread distribution and destructive capacity of these insects suggest the possibility that they may be responsible for greater injury to this plant than has been attributed to them.

Myriapoda.—Several species of millipedes and centipedes are occasionally encountered in corn fields doing a slight and infrequent injury only, by gnawing into the kernels beneath the husks. They are most likely to injure ears which touch the ground, but sometimes climb the stalk as much as two or three feet.

THE CORN INSECTS GROUPED ACCORDING TO THEIR ECONOMIC IMPORTANCE.

The number of insects infesting corn is so very large, and the proportion of them which are seriously injurious to that crop is comparatively so small, that it is necessary, for practical reasons, to separate the important insects from the remainder in this discussion. I have consequently divided the entire list of corn insects into three groups, according to their economic importance, placing in the first group of "the more important corn insects" those which do so serious an injury to the crop that every corn-grower should know the principal facts concerning them as an essential part of his knowlege of farming; in the second group, of "the less important" insects, those which are sometimes definitely injurious but ordinarily do no great harm; and in the third group, of "unimportant" insects, those which do little or no injury to corn as a farm crop, and which may consequently be practically ignored by the farmer as insignificant.

I have thought it best that the first group should be made as small as is reasonable and safe, and have placed no species in it which there was not positive reason to consider as a destructive corn pest. The second group, on the other hand, I have made to include all of the other species which are known to have any tangible economic significance whatever.

The first group may be said to contain those species concerning which every practical corn farmer should know the essential facts; the second group, those additional species which should be familiarly known to the economic entomologist; and the third group, those which are of interest chiefly to the general entomologist—the student of entomological ecology—who wishes an exhaustive knowledge of the entomology of the corn plant.

The present paper, it will be seen, is limited to the first of these groups, and for a discussion of the other two the reader is referred to the official reports mentioned in the foot note on page 220.

SYNOPSIS OF INJURIES.

A. INJURIES TO THE SEED IN THE EARTH.

1. Injuries by ants, which hollow out the kernel, commonly scattering the meal through the dirt. Page 231.
2. Injuries by small beetles, which gnaw the kernel from without, commonly beginning at the germ. Pages 231-232.
3. Injuries by footless maggots, which bury themselves in the seed.
   Seed-corn Maggot. Page 232.
   Black-headed Grass Maggot. Page 232.
4. Injuries by six-legged larvæ, which gnaw or bore through the kernel.
   Pale-striped Flea-beetle. Page 232.
   Wireworms. Pages 232-238 (Fig. 1-16).

B. INJURIES TO THE ROOTS.

5. Roots deadened, hardened, or dwarfed, without apparent loss of substance.
   a. Small brown or yellowish ants abundant in the hills, and bluish green or whitish root-lice (plant-lice and mealy bugs) on the larger roots. Page 238.
   The Corn Root-aphis. Pages 240-251 (Fig. 17-22).
   The Grass Root-louse. Pages 251-252 (Fig. 23-24).
   b. No notable number of insects present. The lowest roots dead; surface of underground part of stalk with brownish corroded spots, interior of this part darker, at least at the joints, while the spaces between may be seemingly healthy. (Root blight of corn, a little understood disease; not entomological.)
6. Roots evidently injured or destroyed by perforations, gnawing, burrowing, decay or other loss of substance.
   a. Roots eaten away, not burrowed or perforated, and without rotten or withered tips; tap-root commonly gone or decayed. White grubs in soil among or beneath the roots.
   White Grubs. Pages 252-263 (Fig. 25-29).
   b. Roots penetrated, perforated, irregularly burrowed, and more or less eaten off and eaten up. Underground parts of stalk also similarly injured. Page 282.
   Wireworms in soil among the roots. Pages 232-238 (Fig. 1-16).
   Small, slender, soft-bodied, yellowish white grubs in the roots and earth. (The Southern Corn Root-worm.) Pages 263-267 (Fig. 30-33).

c. Roots visibly penetrated and perforated scarcely at all; sometimes decayed at tips, but not eaten away. Principal injury interior, in form of minute burrows which are commonly longitudinal, discoverable on peeling or splitting the root, the burrows sometimes containing minute slender white six-legged larvæ, with brown head and neck and brown patch on last segment. (The Northern Corn Root-worm.) Pages 267–273 (Fig. 34–37).

C. INJURIES TO THE PLANT ABOVE GROUND.

The plant cut off when young at or near the surface of the ground by a whitish, grayish, or blackish caterpillar frequently found in the earth near the injured plant. Cutworms (*Agrotis*, *Hadena*, etc.) Pages 273–288 (Fig. 38–56).

The stalk of the young plant eaten into or irregularly gnawed off. The leaves also irregularly eaten. A small, spotted, reddish caterpillar found under ground near the base of the plant in a small mass of earth held together by a web. Sod Web-worms or Root Web-worms (*Crambus*). Pages 288–291 (Fig. 57–59).

The stalk of the young plant penetrated by a round hole which is more or less plugged by excrement. The interior of the stalk irregularly eaten out by a striped burrowing caterpillar. The Stalk-borer (*Papaipema nitela*). Pages 291–293 (Fig. 60).

The entire plant more or less completely eaten, the leaves first and then the stalk, in June and early July, by hordes of traveling striped caterpillars commonly coming into the field from one side. The Army-worm (*Leucania unipuncta*). Pages 293–296 (Fig. 61–63).

The stalk punctured and slit, the leaves perforated by round or oblong holes arranged in parallel transverse rows. Hard-shelled, oval, black or clay-colored snout-beetles often found, head downward, on the stalk near the ground or a little beneath the surface. Corn Bill-bugs (*Sphenophorus*). Pages 297–299 (Fig. 64–66).

Plant wilted or sickly, leaf-edges and lower leaves turned yellow or brown, many small red or dusky, or blackish and whitish bugs behind the leaf-sheaths of the corn, or clustered on outer surface of the stalk. The Chinch-bug (*Blissus leucopterus*). Pages 300–305 (Fig. 67, 68).

The leaves of the plant variously eaten, sometimes stripped to the midrib, about the borders of the field, in late summer or fall. The silks and husks also more or less eaten away. Grasshoppers (*Acrididæ*). Pages 305–306.

The husk of the ear perforated by a round hole with the excrement exuding, the corn mined beneath by a brownish, or greenish, striped caterpillar. The Ear-worm or Corn-worm (*Heliothis armiger*). Pages 307–308 (Fig. 69).

MINOR INJURIES BY ANTS, AND BY BEETLES OR THEIR LARVÆ.

Seed-corn is occasionally hollowed out in the ground both before and after germination by ants which live in the corn fields, three species at least having been occasionally noticed by us engaged in this small injury. One, the common small house-ant, which frequently becomes a nuisance in pantries, is too rare in the corn fields to be worthy of more than this mere mention. A second species, *Myrmica scabrinodis lobicornis*, has been seen by us but once tearing off fragments from a kernel of sprouted corn just below the surface of the soil. The third, the commonest of the corn field ants, *Lasius niger alienus*, the usual companion of the corn root-aphis, has once in my experience done considerable damage in a field of corn by eating into the soft kernels, thus depriving the young plant of the store of food laid up for it in the grain. This had the effect to dwarf the plants, and to give them a relatively sickly look.

A much more serious and general injury to seed-corn in the ground is done by an oblong pale brown beetle (*Agonoderus pallipes*) from a half to a third of an inch long and about a third as wide, with a blackish cloud on the back. Because of its prominence in this relation I have given it the name of the seed-corn beetle. It is very abundant in early spring, flying at night and causing frequent annoyance by its abundance at lights in houses. It hibernates as an adult and leaves its winter quarters with the first warm sunny days of spring. Shortly afterwards the eggs are laid in the earth, and the new generation comes forth abundantly in June and July. It is possible that more than one generation occurs in a season. We have noticed, in fact, an abundance of these beetles at lights on warm September evenings. This insect injures corn by eating out the germ and also by eating the sprouting roots. It is an insectivorous beetle in part, and I have found it devouring young chinch-bugs.

Two still smaller beetles (*Aphodius granarius* and *Clivina impressifrons*) sometimes injure the planted seed, and the larva of still another, the pale-striped flea-beetle (*Systena blanda*), has been once found similarly engaged. Two maggots of flies—one common enough to be known as the seed-corn maggot—and another which I have named the black-headed grass-maggot, are likewise occasionally injurious to the planted seed.

None of the foregoing group are, however, common enough to make it important that measures should be taken to prevent their injuries. I have reason to suppose that dipping the seed in kerosene just before planting will repel all these insects, but, as will be explained at length in another article of this report, this is a dangerous practice in the present state of our knowledge, since seed is sometimes seriously injured by this treatment, and even the young plants may be dwarfed and distorted.

WIREWORMS.

Failure of the seed to start, or a sudden withering of the corn plant when a foot or two in height, especially if the field was broken up from grass one or two years preceding, are always sufficient to warrant a suspicion of injury by wireworms. These hard, smooth, shining, reddish or yellowish brown cylindrical six-legged larvæ* are indeed much more destructive to seed corn, under ground, in Illinois than all other insects taken together. They may begin their injuries to the seed almost immediately after the planting, commonly burying their heads in it at first, sometimes eating entirely through the kernel, and even devouring it completely. If they attack the growing plant they are likely to eat the smaller roots, or to penetrate or bore through the larger ones, dwarfing or killing the corn; and later, when the young plant is several inches high, they frequently kill it outright by boring their cylindrical channels directly through the underground part of the stalk. They are far the commonest in corn on ground which has lain for several years in grass, and are much more likely to do serious mischief the second year after the breaking up of the sod. They should be sought for diligently on such lands whenever the seed fails to grow, or when the sudden withering of the plant hints at a serious damage to it under ground. At such times practically all the wireworms in the field will be found in the hills of corn or in their immediate vicinity, sometimes as many as ten or a dozen in each hill.

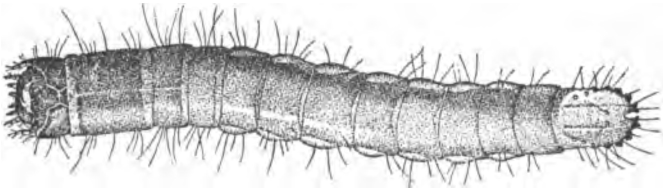

FIG. 1.—Larva of *Drasterius elegans;* enlarged seven diameters.

Although wireworms are rarely distinguished by farmers as of different kinds, there are no less than 100 species of these insects known to occur in Illinois in the adult or beetle stage, and eight species of the larvæ (the so-called "wireworms" themselves) have been found by us here injurious to corn. These corn wireworms have, however, so strong a family resemblance that

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*This general description of the wireworms does not apply to one very peculiar form (*Cardiophorus*), taken by us but once in Illinois.

they are little likely to be confused with any other insect by the fairly good observer who has once learned to recognize any one of them. They vary in length, when full grown, from half an inch to an inch and a quarter, but agree in their hard, crust-like surface nearly destitute of hairs; their brownish color, varying from yellowish to reddish; their slender bodies, distinctly segmented, and of about equal diameter throughout their length; their flattened heads, with jaws borne in front and extending horizontally forward;the six pairs of short, stout, jointed legs on the three segments following the head; the absence of legs of any kind on the eight segments thereafter; and the single sucker-like proleg on the under surface of the last segment of the body—the thirteenth, counting the head as one. This terminal segment is often peculiarly finished above—concave or convex, notched, toothed, or lobed at the sides and end, or, in one species, with a pair of conspicuous round openings on the upper surface. Taken in the fingers, the wireworms bend and wriggle with surprising strength, and easily slip out of the grasp.

They live regularly and normally in grass-lands, feeding on roots of grass, where, however, their numbers are rarely sufficient to produce any notable effect upon the sod. It is only when concentrated in the comparatively scanty vegetation of a field of young corn in spring, or occasionally in young wheat, or other small grain, that they do any very marked or important harm. They are to be found in grass of every description, from prairie sod and the coarse and rank sedges along the borders of marshes, to the cultivated grass of our pastures and meadows.

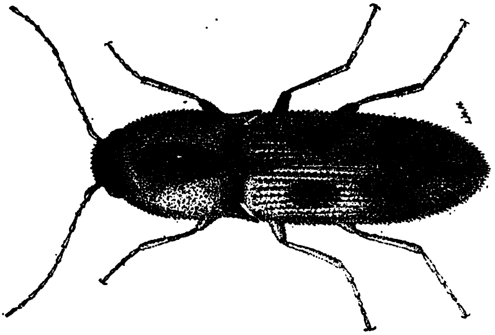

FIG. 2.—*Drasterius elegans*, beetle; enlarged seven and a half diameters.

The commonest form of attack on the corn, as seen by the farmer, is perhaps the burrowing of the worm into the seed kernel, either before or after it has sprouted. All the species treated in this paper have been seen with their heads buried in the kernels, either in the field or in breeding-cages. Frequently attacks in the field have been so severe, particularly the first or second year after the sod has been broken, as to require planting a second or third time. *Drasterius elegans* (Fig. 1 and 2) and *Melanotus fissilis* have been taken in the act of perforating stalks just above the root. In a field at Peru, Illinois, examined July, 1883, as much as 6 per cent. of the corn in the field had been killed in this way, sometimes two or three larvæ being found in a single stem.

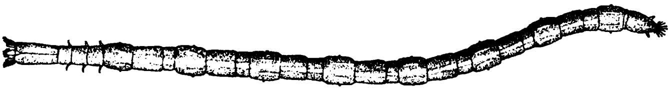

FIG. 3—*Cardiophorus sp.*, larva, dorsal view; enlarged four diameters.

The roots of the corn are also eaten to a greater or less extent by all the species, the damage from this cause being sometimes quite considerable. A field in Alexander county visited in June, 1886, had spots of 100 to 200 hills not more than a foot high, while the balance of the field was four or five feet high. Many hills in these spots were gone. In the smaller hills many small, slender, peculiar looking larvæ of an unknown species of *Cardiophorus* were found. (Fig. 3.) In some instances they had almost completely destroyed the roots of the corn; in others the roots were bored through and the outer surface eaten away so as almost to destroy their usefulness.

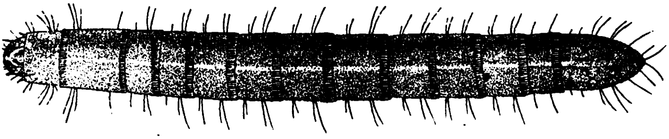

FIG. 4.—Wheat Wireworm; enlarged five diameters.

Agriotes mancus is so destructive to wheat as to be known as the "wheat wireworm" (Fig. 4, 5, and 6). *Drasterius elegans* is also known to infest this crop, as do other species as well. Rye, barley, and oats also suffer from wireworm attacks. Dr. Fitch also found them burrowing in timothy bulbs. Wireworms taken from a dense clover sod and placed in our breeding-cages, where they were supplied only with grass and clover, gave us imagos of *Asaphes decoloratus*. (Fig. 7, 8, and 9.)

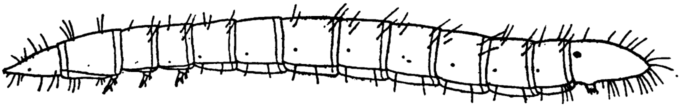

FIG. 5.—Side view of Wheat Wireworm.

Among root crops, potatoes often suffer from being bored into and by having the surface gnawed and corroded by these worms; but turnips, it is said, appear to be more infested by them than any other root crop.

Besides the crops already mentioned Dr. Fitch names the following, which the wireworms are known to attack or are recorded as attacking: mangel-wurzel, cabbage, carrots, beets, onions, lettuce, rape, hops, strawberries, pinks, carnations, dahlias, lobelias, and numerous other garden flowers. They have also been reported to me by a horticultural friend as destroying planted peach pits in the earth.

GENERAL STATEMENT OF LIFE HISTORIES.

The injurious species agree fairly well in the main features of their life history, changing to the dormant pupæ in the earth in July or sometimes in August, and changing again some three or four weeks later to the brown or reddish beetles commonly known as "click-beetles" or "jumping-jacks"—hard, somewhat hairy insects, of slender oval form, distinguished at once by their peculiar habit of springing into the air with a sudden click when placed upon their backs. A large part of these fully developed beetles remain under ground until spring, enjoying there the protection of the oval earthen cavity or cell formed by the larva as a preparation for pupation. A part, however, come forth from the ground in fall, passing the winter in sheltered places, and the remainder emerge in spring, laying their eggs most commonly in grass-lands in the earth. Of their subsequent life history little is yet definitely known. It seems certain that all live more than one year as wireworms in the earth, and observation of the various sizes of larvæ of the same species to be found in the field at once, usually supports the common impression that the period of life in the larval stage does not extend beyond two years; a fact which, taken in connection with the death and decay of grass roots the first year after breaking up the sod, serves to explain the greater damage done by wireworms the second year the ground is in corn. The number of wireworms

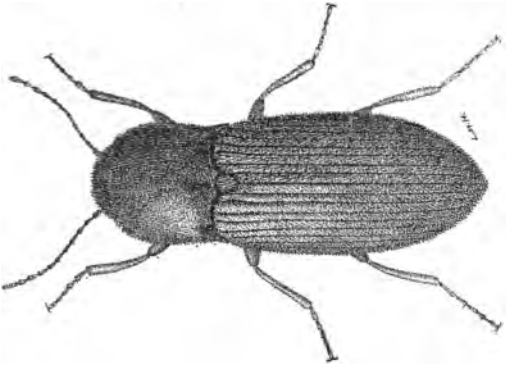

FIG. 6.—Beetle of Wheat Wireworm; enlarged seven diameters.

having been little diminished since the crop was changed, and their original food having practically disappeared, they are compelled to concentrate upon the corn—either the newly planted seed or the young plant while it is still very small.

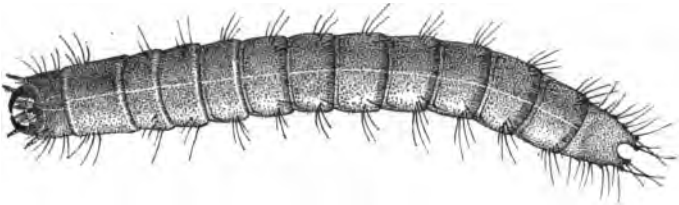

FIG. 7.—Larva of *Asaphes decoloratus*; enlarged three and three fourths diameters.

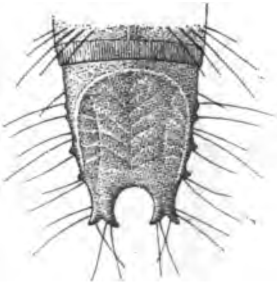

FIG. 8.—Last segment of larva of *Asaphes decoloratus;* much enlarged.

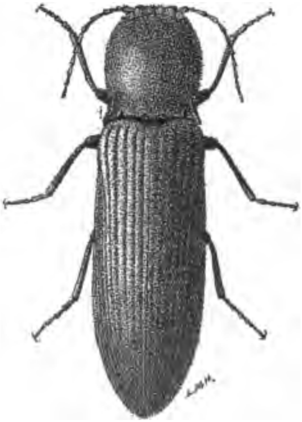

FIG. 9.—Beetle of *Asaphes decoloratus;* enlarged four and a fifth diameters.

PREVENTION AND REMEDY.

Probably no class of agricultural insects has had prescribed for it a longer list of artificial remedies than the wireworms, and certainly no such list has been of less practical value. After many generations of experience with their work in this country and in Europe their injuries continue at present practically unchecked by any treatment consistent with the methods of American agriculture.

Even poisons of the most deadly sort applied to corn previous to planting, or to food lures distributed through the ground for the purpose of drawing off the attention of these insects from corn, have proved almost entirely valueless, both in my experience and in the more elaborate trials made by Comstock and Slingerland in New York. Late fall plowing, breaking open the pupal chambers within which the recently transformed adults pass the winter, will probably have the effect to diminish generally the number of these beetles during the following year. Comstock and Slingerland have also ascertained that the adult beetles are susceptible to certain poisons judiciously distributed with certain attractive kinds of food; and I have to suggest a systematic rotation intended to interpose between grass and corn a crop not vulnerable to the wireworms. Otherwise we are substantially without a hint of any means of diminishing the ravages of these insects other than the time-honored resource of the corn farmer, namely, late planting of his corn the second year after sod and late replanting if the first planting is destroyed. In the latter case it is well to plant between the rows, allowing the first corn to stand as long as is consistent with a proper cultivation of the field. All the wireworms being at the time concentrated in the old hills of corn, if these be destroyed when the field is planted the second time the wireworms still active in the earth are forced to attack the freshly planted kernels as their only food resource.

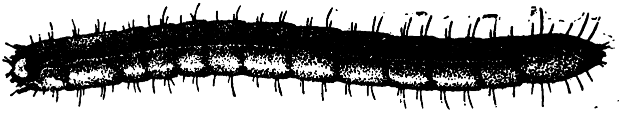

FIG. 10.—Corn Wireworm; enlarged four diameters.

The first experiments with poisons for the wireworms of which we have definite record, were made at my office in 1885, and reported briefly in my "Miscellaneous Essays on Economic Entomology" (p. 18), printed the following year.

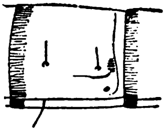

FIG. 11.—Side view of a middle segment of Corn Wireworm.

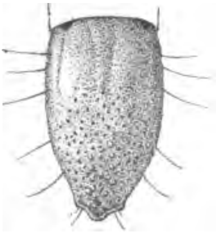

FIG. 12.—Last segment, dorsal view; greatly enlarged.

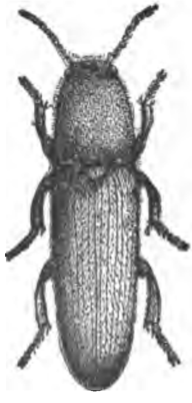

FIG. 13.—Beetle of Corn Wireworm; enlarged four and a half diameters.

Later, in May, 1888, we fed thirty-seven wireworms on corn soaked for seven days in a mixture of water and Paris green. The corn was covered with a coating of the green poison, but was eaten freely by some of the worms without killing them. Twelve wireworms fed on corn soaked in Fowler's solution diluted with an equal quantity of water were not affected, although a portion of the corn was eaten. Twelve others, fed on corn soaked in an alcoholic solution of arsenic, were not injured by the poison though feeding freely on the corn. Experiments in June and July, when wireworms were fed on corn soaked in a solution of arsenic in boiling water, were less satisfactory because the larvæ were so near pupation that they ate little or none, pupal cells being formed five days after the experiment began. Corn soaked in a solution of strychnine—four grains to a half pint of water—over night and fed to seven wireworms June 28, 1888, had not affected them by July 5th, although the corn was slightly eaten. Twelve worms supplied with corn soaked twenty-four hours in an alcoholic solution of corrosive sublimate June 27, 1888, did not eat the corn.

A repetition of these experiments in June and July, 1891, by a different assistant and under somewhat different conditions, gave substantially the same results. June 27, 1891, corn was soaked in a saturated solution of potassium cyanide and fed to three wireworms. July 3d one grain of corn was slightly eaten, and July 10th one grain was badly eaten and one worm missing—probably eaten by mice that had obtained access to the cage. July 20th several grains were badly eaten; July 27th the remaining two worms were active, but the corn was untouched; and the experiment ended without effect.

In many of the experiments, particularly when alcoholic solutions were used, or where the corn was soaked for a considerable length of time in arsenical solutions, it failed entirely to germinate; while in experiments where the grain was simply wet and rolled in the arsenites, or soaked for only a few hours, it grew almost as freely as did untreated corn in check lots.

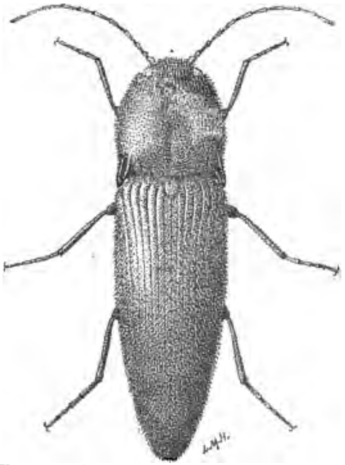

FIG. 14.—Beetle of *Melanotus communis;* enlarged four diameters.

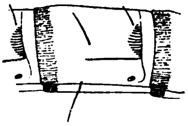

FIG. 15.—Side view of a middle segment of larva of same species, showing muscular impression, spiracle, etc.

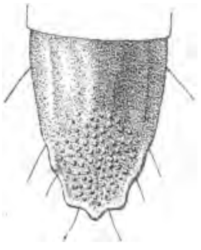

FIG. 16.—Last segment of same, dorsal view; greatly enlarged.

These experiments with the arsenical poisons and strychnine agree substantially with those of Messrs. Comstock and Slingerland, published in November, 1891, and show that it is not practicable to protect the corn by means of them, even were it possible to use them without retarding or preventing the germinating of the seed.

Coating the kernels with tar and soaking them in a solution of salt, a solution of copperas, a solution of chloride of lime and copperas, in spirits of turpentine, and in kerosene oil, have been tried by Comstock and Slingerland without encouraging results.

Applications of kerosene emulsion and pure kerosene made to the worms in the earth were found by me in 1885 practically ineffective, any strength sufficient to kill the larvæ killing vegetation also. Similar results were obtained by Comstock and Slingerland, who, after using crude petroleum, an emulsion of the same, and a common kerosene emulsion, concluded that the last is more promising than the others, but that it can not be profitably applied on a large scale. Experiments made by them show also that even a clean fallow for an entire season will not starve out the worms; that neither buckwheat, mustard, nor rape crops—frequently recommended to clear the earth of wireworms—will accomplish the desired result; and that salt applied at the rate of 1,600 pounds to the acre—a heavy dressing—neither drives the wireworms deeper into the soil nor causes them to migrate to any appreciable distance; that kainit used as a fertilizer, even in very large quantities, had little effect if any on the wireworms; that muriate of potash—four to six tons to the acre (an excessive amount)—is but slightly effective; that lime at the rate of even 200 bushels per acre does not injure wireworms; that chloride of lime must be used in impracticable quantity to produce any marked effect; and that gas-lime, although capable of destroying the wireworms, must be applied in such great quantities that its use is impracticable on large areas. Bisulphide of carbon poured into a hole in the earth near the infested hill destroys the wireworms, but at an excessive cost.

The most promising preventive of wireworm injury to corn is a standard rotation with corn, oats, and clover in succession, neither crop running for more than two years on the same ground. Grass-lands might then lie as long as desirable, but should be pastured by hogs before breaking up, to clear them of wireworms, white grubs, cutworms, and other grass insects likely to injure other crops, and they should then be plowed in late summer or early fall. If clover were sown on such land the following spring, either with oats or on winter wheat or rye, and allowed to stand for a second year, this might be followed by corn with a positive assurance that wireworms originally in the sod would have entirely disappeared.

The general entomological effect of some such management could not fail to be beneficial, since it would apply to cutworms and white grubs as well as to the wireworms now under discussion. The system of rotation now common in central Illinois is, indeed, seriously defective in the fact that the plants composing it—Indian corn, small grains and grasses—are all of the same botanical family and consequently subject in large measure to the same enemies.

PLANT-LICE AND MEALY BUGS.

APHIDIDÆ AND COCCIDÆ.

Associated with ants in hills of corn, the observer may find any one or more of eight species of minute, soft, thick-bodied, six-legged insects, sometimes winged, but usually without wings, and always of very sluggish habit and slight power of locomotion. When exposed, they may show little or no signs of disturbance, but if shaken off the roots into which their stout jointed beaks are thrust, they will probably crawl slowly and clumsily about, making movements almost too sluggish and aimless to look like efforts to escape. The ants which have nested in the hill will, however, commonly seize these little insects in their mandibles and hurry away with them into concealment.

By far the greater part of those answering to the above description to be found in the corn field, will usually be plant-lice (aphides); and will mostly belong, in fact, to a single species, the corn root-aphis; but a few may be "mealy bugs" (genus *Dactylopius*, family *Coccidæ*), recognizable as such by their general resemblance to the kinds of "mealy bugs" common in greenhouses. They may be readily distinguished from the plant-lice by their thicker, clumsier bodies, and by the almost rudimentary size of their legs and antennæ. They are always covered with a mealy or powdery excretion of minute particles of wax, and never have honey-tubes, or cornicles, on the back of the abdomen—both, however, characters in which they agree with some of the lower plant-lice. From all the corn-infesting plant-lice they may be technically separated by the fact that their tarsi are single jointed and bear but a single tarsal claw, while the plant-lice of this group have two tarsal joints and a pair of tarsal claws.

Plant-lice are among the most prolific of insects,* producing several generations annually, but they are commonly held severely in check by climatic, meteorological, and biological conditions; that is, by season, weather, and plant or animal parasites. They are consequently capable of rapid and enormous increase when any of these checks are temporarily weakened to any considerable degree. As they affect the plant by abstracting the elaborated sap upon which its vital activity depends, the injury done is usually general, and especially is this true if the root be the part infested. Some species, however, in addition to this general drain upon the life of the plant, cause a distinct local deformity to root or leaf in the nature of a gall, which protects them at the same time that it secures them food. Any crop liable to their attack in force is never long free from danger, but, on the other hand, a seemingly irresistible outbreak may disappear as quickly as it came, a slight and almost imperceptible change of conditions often taking tremendous effect on these delicate insects.

Economically, plant-lice may be divided, according to the peculiarities of their life histories, into several groups or classes. Some generation, or some part of some generation, may grow wings, fitting them for rapid dissemination, or the species may be without winged representatives. They may live through the whole season of their active life above ground, on exposed parts of the plant; they may spend the whole season under ground, upon the roots; or they may alternate, spreading each year from roots to stalk and leaves and back again. Whatever part of the plant they infest, they may live on a single host species, they may spread indefinitely from one to several others, or they may migrate definitely, by means of a fixed generation, from one species to another, requiring thus for their continuance two plant species often extremely unlike.

Finally, the sexual, oviparous generation (commonly the last to appear in fall) may leave its eggs on the exposed parts of the plant last infested, or it may deposit them in the earth among or on the roots of its host. In the former case the destruction of the plant, or of its remains, will destroy the lice; in the latter, the eggs rest like a seed in the earth to stock the ground the following spring with a horde of young, ready to infest the succeeding crop if suited to their tastes and habits.

All the plant-lice of our present list of species infesting the roots of corn are, so far as known, subterranean only, producing no galls, but leaving their eggs in the earth over winter. They infest more than one plant, spreading from one to another species in an indefinite manner, not definitely migrating. The corn and grass root-lice (*Aphis maidiradicis* and *Schizoneura panicola*) develop early in the season winged forms by which they easily spread from field to field.

Six species of plant-lice, belonging to as many different genera, have been found by us habitually infesting corn roots in Illinois. By far the most important of these is that commonly known as the corn root-aphis. This is, in fact, the only one on the list which infests corn primarily as a principal food plant, the others being essentially species of the meadow and pasture, attacking corn but lightly, and most commonly only when it follows grass.

The association of all these species with ants, which care for them in many ways, some of them indispensable, and feed in turn on excretions of their insect charges, is a fact of special economic significance, since the ant most active in preserving the plant-louse species must be taken into account as a factor in the economic problem.

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*Slingerland has bred twenty-five generations of a plant-louse (*Myzus achyrantes*?) in a single year (Science, Vol. XXI., 1893, p. 48); and Buckton shows (A Monograph of British Aphides, Vol. I., p. 80) that a single rose aphis (*Siphonophora rosæ*) might give origin, at its normal rate of unchecked multiplication, to over thirty-three quintillions of plant-lice in a single season, equal in weight to more than a billion and a half of men.

THE CORN ROOT-APHIS.*

Aphis maidiradicis Forbes.

(Fig. 17-20 and the colored plate.)

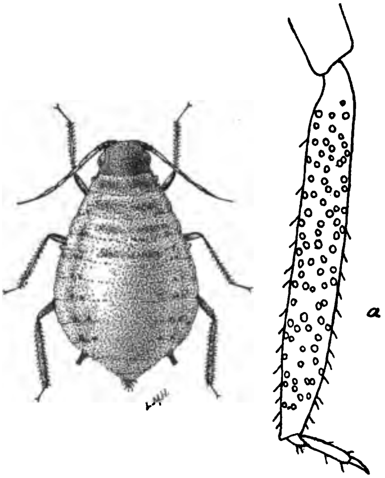

FIG. 17.—Corn Root-aphis, oviparous female; enlarged fourteen diameters: *a*, hind tibia, showing sensoria.

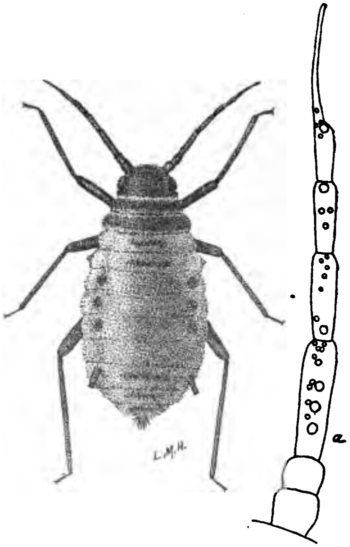

FIG. 18.—Male of same species; enlarged twenty-five diameters: *a*, antenna.

No insect affecting corn is more deserving of the attention of farmers and entomologists at the present time than the corn root-aphis. It ranks as a corn pest with the chinch-bug and the army-worm, less injurious at any one time than these are locally and occasionally, but overtaking them, on the other hand, by its general distribution and the constancy of its attack. Although it lives upon the roots throughout the life of the plant, the principal damage is done at the same time as that caused by wireworms—while the corn is still small. It contrasts with the corn root-worms with respect to the time of its most injurious activity, the latter coming in at about the time when the aphis generally begins to loosen its hold; but the two agree in the fact that they make their first appearance in spring only on ground which has been in corn for at least a year preceding. The common root-worm is confined throughout the season to the field in which it hatches, while the aphis presently scatters abroad, more or less freely according to the percentage of the second and succeeding generations which develop wings. Its life history has now been well made out, and preventive measures are fairly well settled by my own recent work. When corn ground infested by this aphis is sown to oats, the root-lice hatching the following spring have disappeared from it completely before the end of May, and rotation of crops is consequently a valuable measure of protection. Frequent stirring of the ground to the depth of five or six inches before planting to corn is an important method of prevention, as will be explained in detail on another page.

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* A colored plate of this insect in several of its forms and stages is printed in another part of this report.

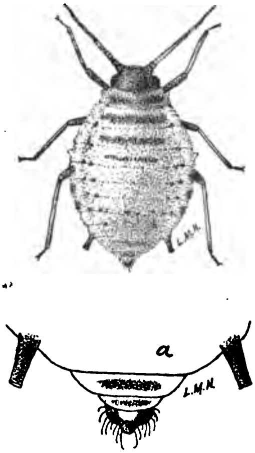

FIG. 19.—Corn Root-aphis, wingless viviparous female; greatly enlarged; *a*, apex of abdomen showing cornicles, tubercles, and cauda.

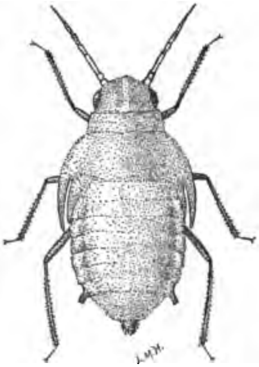

FIG. 20.—Pupa of same species; enlarged twenty-one diameters.

INJURY TO CORN.

The corn root-louse is a suctorial insect, taking only fluid food through a stiff beak, which it thrusts into the tissues of the plant it feeds upon, producing thus no external injury, nor, indeed, any local internal effect discoverable by ordinary methods of observation. Indications of injury by this insect are consequently all of a general character, affecting the entire plant, and do not materially differ from those caused by severe drouth, except in the fact that they are likely to be unequal in different parts of the same field in a way to indicate no connection with the amount of retained moisture in the soil.

A noticeably greater abundance in early spring in the lower parts of an infested field seems to be due to the greater abundance there of young weeds on which the corn root-aphis feeds at first. As soon as the corn starts to grow it may become infested, and even be killed outright before it appears above ground. We have, in fact, found the root-louse on the plant as early as May 9, only four days after the field was planted.

The dwarfing of the plant, especially in patches here and there, with a yellowing or reddening of the leaves—beginning of course with the lowest ones—and a general apparent lack of thrift and vigor, are sufficient to cause suspicion of injury by this louse, a suspicion which will be confirmed in part if numerous burrows of ants are seen in or near the hills of corn. The presence of ants in the field may be overlooked after the ground has been recently cultivated, but can scarcely escape attention shortly after a rain, when these little insects actively open up their burrows, heaping up the little pellets of earth about the openings of their nests.

The appearances described may, nevertheless, be due either to the corn root-blight—a disease not caused by insects, and hence not treated in this report—or to the grass root-louse, a species likewise attended by ants, but far less injurious to corn than the aphis under discussion. If the damage be due to the root blight, the root-lice themselves will be few or wanting; and if to the grass-louse, the fact may readily be ascertained by an examination of the roots of the corn.

The root-aphis of the corn is of a bluish green color, slightly whitened by a waxy bloom. The form of the body is oval, and on the hinder part of the back are two short, slender, but conspicuous, tubes, standing erect or projecting slightly backwards, which may be seen by the glass to have open ends externally. These are called the cornicles of the aphis, or, sometimes, the "honey-tubes," it having been formerly supposed that they were the source of the abundant excretion upon which the ant attendants of the lice eagerly feed. The grass-louse (Fig. 24 and 25), on the other hand, is white in color, with a blackish head and other blackish markings, but without any tint of green; and it has no trace of cornicles, their place being taken by two minute openings in the corresponding segment of the body, each surrounded by a delicate brownish rim.

The evidences of serious injury by the corn root-aphis are, in short, an unusual dwarfing and discoloration of the corn, an abundance of small brown ants in the field, nesting among the hills, and, finally, the presence of the bluish green insects themselves upon the larger roots of the corn, especially near the base of the stalk.

The amount of injury may vary from a scarcely noticeable check upon the growth of the plant to a total destruction of the corn over considerable patches, up to half an acre or more. This more serious effect is, however, rarely, if ever, produced by the root-louse alone. Like most insect enemies—especially those of suctorial habit, which abstract the sap of the plant they feed upon—the corn root-aphis serves to intensify the effect of drouth and other unfavorable influences, and it is often difficult to say how much is to be ascribed to the action of the insect pest and how much to other causes coöperating.

There is some evidence to the effect that a too serious check to the growth of the corn results in the early evolution of a great number of winged plant-lice of the second spring generation, whose escape from the fields in which they start so breaks the force of the attack that in a favorable season very badly damaged plants may rally and make good corn; but if the insect injury is followed or reinforced by drouth the corn may grow sluggishly the whole season through, and either fail to ear or bear small imperfect nubbins only. Sometimes a field not infested the year before is permanently damaged in June, or even late in May, as the result of an early accidental concentration of the winged lice originating in other fields.

INJURY TO OTHER PLANTS.

No other crop plants are especially liable to injury by this aphis, unless possibly we should except broom-corn and sorghum. Although not at all uncommon on these plants it does not commonly thrive on them, and, so far as my observations have extended, can scarcely be called injurious to them. It has been observed in the field, however, or bred in the insectary, on the roots of a number of other species of plants, some of which are, in fact, important to its maintenance. Many of the first generation hatch from the egg in the field before the corn is ready to receive them, and at this time young smartweed plants and foxtail-grass (*Polygonum* and *Setaria*) are their principal resource. These plants harden early and lose the succulence which makes them especially desirable to plant-lice, a fact which accounts in part no doubt for the early transfer of the lice to corn; but in fields of small grain *Setaria* and *Polygonum* may continue to support the corn root-louse at least until the second generation is well matured. Indeed, I have found this insect on the roots of smartweed more than a foot high as late as June 17. Crab-grass (*Panicum*) also becomes infested but less abundantly than the *Setaria*, and from the latter part of June throughout the rest of the season the aphis breeds abundantly on the common purslane (*Portulaca oleracea*). We have occasionally found it so abundant on purslane plants far removed from corn fields—beside paths in lawns and in other similar situations—that one might well regard this as a purslane aphis, if it were not for the fact that this weed starts too late in the season to serve as food for the earlier generations.

We have also evidence that the corn root-aphis may live on the roots of ragweed (*Ambrosia*), having indeed found it on that plant in the field and kept it for several days upon ragweed roots in the insectary. The fall oviparous generation and the one preceding it have been repeatedly reported by my field assistants—who were constantly dealing with the root-aphis and knew its characters perfectly—to have abundantly infested dock (*Rumex crispus*), fleabane (*Erigeron canadense*), mustard (*Brassica nigra*), sorrel (*Oxalis stricta*), plantain (*Plantago major*), Hungarian grass (*Setaria germanica*), pigweed (*Amarantus hybridus*), and squash; but as these statements were not verified by successful transfers from these various plants to corn, they rest only on determinative evidence, notoriously unreliable with respect to the plant-louse species. Indeed, an attempt at transfers of the supposed corn-aphis found on squash, sent me from Ohio by Prof. C. M. Weed, entirely failed. A similar result was reached in an attempt to transfer known corn root-lice from corn to wheat and oats begun April 22, 1889. Insects placed on roots of wheat in breeding-cages April 22 continued to live there until May 5, but without producing young. May 11, however, all had left the plants. An earlier experiment begun April 10 had a like ending, and a precisely similar result was obtained in a parallel experiment with oats.

The repugnance of this insect to the roots of small grain was repeatedly shown also by field observations. Fields of oats and wheat on old corn grounds, sometimes known to have been badly infested by the root-aphis the preceding year, often contained in April and May large numbers of these root-lice and their associated ants, the former feeding on the roots of smartweed and pigeon-grass growing with the grain, but never being seen on the roots of the grain even where these and the grass roots were closely interlaced.

The relation of this louse to other plants than corn has an important economic bearing. For example, in fields on old corn ground, the first generation of plant-lice are very noticeably more abundant early in spring in the lower parts of the field than elsewhere, especially in those parts so situated as to receive the wash from the remainder. I can at present only account for this unquestionable fact by the very much greater abundance here of young smartweed plants, doubtless due to the washing down of the seeds left on the ground in fall. This seems especially likely to be the true explanation, since the difference in the number of plant-lice on low and high ground in the same field diminishes greatly or entirely disappears with the advent of later generations and the scattering of the winged lice abroad.

LIFE HISTORY.

General Statement.—The corn root-aphis passes the winter as an egg in the earth, in corn fields or, rarely, in other grounds where purslane grows late in fall, always, so far as known, only in the nests of a small brown ant about an eighth of an inch long, known to science as *Lasius niger* or its variety, *L. niger alienus*. This ant is the constant companion of the root-louse throughout the year, living in burrows among the roots of the corn. The aphis eggs begin to hatch about the time of the opening of the seed leaves of the smartweed or heartweed (*Polygonum persicaria*), abundant in cultivated ground. This first of the spring generations is readily distinguished by characters of form and color from all that follow. Appearing usually before the corn is planted, it is dependent at first, in our region, almost wholly upon the young smartweed plants. The roots of these are laid bare by the burrows of the ants, and upon these roots, within their narrow tunnels, the lice will usually be found thickly clustered. Later, if the field be not planted to corn, our common species of pigeon-grass (*Setaria*) divides the attention of the lice, offering in fact, for a little time a more succulent herbage than the rapidly growing smartweed.

The second generation begins to appear about the 1st of May—we have one breeding-cage record of the 28th of April—and by the middle of that month may be itself mature. Many of this generation are winged, while others are without wings,* the winged form first occurring about May 10.† These "migrant" root-lice may live at first, like those of the preceding generation, upon smartweed and pigeon-grass, but more commonly they are transferred to corn by the little brown ant already mentioned, either in the same field or after they have flown to another. These ants not only carry from weeds to corn the root-lice already in their possession, but burrow hills of corn in advance, eagerly seizing and conveying to their subterranean galleries winged root-lice which come their way.

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* Two young of this generation, born of the same mother in a glass tube enclosing a corn root, were kept by us until adult, when one proved to be a wingless aphis and the other winged.

† This generation is at its best from May 15 to 20 in average years in central Illinois.

The succeeding generations are not of special economic interest with the exception of the last to occur—the autumnal, bi-sexual brood, by which the eggs are laid. Both males and females of this brood are wingless, and live in the earth like their parents, occurring there from the middle of September to the middle of November. The eggs which they lay are taken in charge by their attendant ants and cared for during the winter.

Number of Generations.—The eggs of the corn root-aphis have hatched under our observation as early as April 8, this process continuing until May 20. The average period from the time the aphis is born until it begins to reproduce is about nineteen days for the first three generations. It shortens rapidly, however, with the progress of the season, and in June and July it averages about eight days. Many breeding-cage experiments made during 1905 give us a maximum number of fifty-four young born from a single parent, with an average of twenty young per mother in twenty-six different cases.

Migration to Uninfested Fields.—The last autumnal brood of the corn root-aphis lives, so far as known, only upon roots of corn and purslane, the latter being usually infested in corn fields only, and in these situations, consequently, the eggs are left from which young hatch the following spring.* This first spring generation being always without wings, the root-aphis is practically confined for a little time to fields previously in corn. As a considerable part of the second generation acquires wings, a general dispersal of adults begins almost as soon as the corn is out of the ground. These winged root-lice do not, however, become sufficiently abundant for a considerable time thereafter to noticeably affect fields not in corn the year before. Previous to the first of June this distributed attack can scarcely be detected, and not until July 1 have we found it really serious anywhere.

The evolution of winged root-lice is not confined to any single generation, but continues throughout the season in numbers varying according to some law not yet ascertained. It is to be noticed, however, that we have taken the winged form in August but once, although our collections of wingless specimens were made on twenty-seven days within that month. In September also the winged louse is relatively rare, occurring but three times in twenty collections made on as many different dates. By November the viviparous generations are all dead, as a rule, and the species is thereafter represented only by the sexual generation and the eggs.

RELATION TO ANTS.

Seven kinds of ants have been found by us fulfilling the relation of host, guardian, and nurse to the corn root-aphis. The occurence in this relation of all but two (*Lasius niger* and *Lasius niger alienus*, Fig. 21 and 22) is so rare that they need receive here no more than this passing mention, especially as their services to the aphis are, so far as observed, the same in character and value as those of the much more abundant species.

The fact has already been mentioned in this paper that the sexual egg-laying generation of the corn root-aphis—the last to appear in fall—is born in the galleries of the nests or homes of ants, and that here the sexes pair and the females drop their eggs. As one explores these nests in November, when the root-louse eggs are being laid, he is struck with the relative independence of these oviparous adults, which are allowed to wander unattended through the burrows of their hosts as far as a foot or more from a corn root. We have found them, however, still feeding as late as Nov. 5, and laying eggs Nov. 21. These eggs are yellow when first deposited, but soon become shining black, and turn green just before hatching. They are at first scattered here and there, as it happens, but are finally gathered by the ants for the winter in little heaps and stored in their galleries, or sometimes in chambers made by widening the gallery as if for storage purposes. If a nest is disturbed, the ants will commonly seize the aphis eggs—often several at a grasp —and carry them away. In winter they are taken to the deepest parts of the nests (six or seven inches below the surface in some cases observed) as if for some partial protection against frost; but on bright days in spring they are brought up, sometimes within half an inch or less of the surface, sometimes even scattered about in the sunshine, and carried back at night—a practice probably to be understood as a means of hastening their hatching. I have repeatedly seen these ants in confinement with a little mass of aphis eggs, turn the eggs about one by one with their mandibles, licking each carefully at the same time as if to clean the surface. These anxious cares are of course explained by the use the ants make of the root-lice, whose excreted fluids they lap up greedily as soon as the young lice begin to feed. They are not, however, wholly dependent on this food supply, at least in early spring, as I have seen them kill and drag away at that season soft-bodied insect larvæ, doubtless to suck their juices out as food. This has been a somewhat rare occurrence, however, and has rarely been noticed by us among ants which had plant-lice in their possession. Once, however, ants of this species occurring abundantly in corn fields were observed Sept. 22 to carry bits of dead insects into their burrows, together with a living corn root-louse. Similar observations have been made in May and June, 1905.

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* Among more than fifty lots of "stem mothers" of the corn root-aphis collected by us in the field, every one was found in ground which had borne corn for at least the year immediately preceding.

That the young of the first generation are helped by the ants to a favorable position on the roots of the plants they infest is quite beyond question. It is shown (1) by the fact that in many cases the aphis could not get access to such roots unless these had been previously laid bare by the tunneling of the ants, and (2) by the behavior of ants with mines already constructed, when the root-aphis is offered to them. We have repeatedly performed the experiment of starting colonies of ants on hills of corn in the insectary and exposing root-lice from the field to their attentions, and in every such instance, if the colony was well established, the helpless insects have been seized by the ants often almost instantly, and conveyed under ground, where we would later find them feeding and breeding on the roots of the corn. In many cases in the field, we have found the young root-aphis on sprouting weeds (especially pigeon-grass), which have been sought out by the ants before the leaves had shown above the ground; and, similarly, when the field is planted to corn these ardent explorers will frequently discover the sprouting kernel in the earth, and mine along the starting stem and place the plant-lice upon it.

We have also abundant evidence that ants excavate hills of corn in very early spring, when they have as yet neither eggs nor plant-lice in their possession, and some days before the possible appearance of the second generation. When winged lice of this second generation begin to appear, it is a common thing to find the small brown ant scattering far and wide over fields not previously in corn, and containing consequently no plant-lice in any stage, burrowing there the hills of corn, and carrying under ground such corn root-lice as come within their range.

I need hardly say that the relations above described between the corn root-aphis and these ants continue without cessation throughout the year, the succeeding generations being quite as useful to the ants as those whose history I have thought it worth while to follow in detail.

ECONOMIC PROCEDURE.

Our present knowledge of the life history of the corn plant-louse suggests four possible methods of attack. (1) We may try the effect of a change of crop after any notable plant-louse injury to corn, in the expectation that corn planted on ground which contains no plant-louse eggs will become so slightly or so slowly infested, if at all, that no harm need be anticipated. (2) In view of the fact that injury to the plant if infested by root-lice depends in great measure upon the vigor and rapidity of its growth, we may fertilize freely to sustain it against insect attack at a time when this is most likely to be injurious. (3) We may try so to treat the seed with some persistent substance repellent to the ants and root-lice, or injurous to them, that they shall avoid the young corn, at least until it has made a sufficient start to be able to sustain their attack with relatively little injury. Moistening the seed with kerosene or turpentine has been often advised by farmers, and some experiments of my own go to show that hills so treated will be avoided by these insects. On the other hand, the young plants are sometimes liable to serious and even fatal injury as a result of the application of these substances to the seed. A long series of experiments made by us during the season of 1905 has given results so variable in this respect that I am not at present able to make any definite recommendation on this point. (4) Since the small brown ant cares assiduously for the eggs in winter and spring, we may assume the necessity of such care and strive to find means of so disturbing the nests of the ants, or of breaking up and dispersing their contents in late fall or in winter, that their stores of aphis eggs can not be recovered by them, and so shall be left to perish. (5) Taking account of the early hatching of the eggs in spring—many days, as a rule, before the usual time for planting corn—and the dependence of the young lice for food at that time on sprouting weeds in the field, especially smartweed and pigeon-grass, and remembering also that they can not place and maintain themselves without the aid of the ants, we may perhaps treat the ground in spring previous to planting in such a manner that the homes of the ants shall be repeatedly destroyed and their contents widely scattered through the earth. The same treatment will, of course, tend to keep down the growth of young weeds in the field upon which the lice are at this season able to feed.

Rotation of Crops.—There can be no doubt that a judicious rotation of crops has the effect at least to diminish injury by the corn plant-louse by distributing its attack; and there is also considerable reason to believe that it must result in the destruction, direct or indirect, of a certain proportion of the insects themselves. Corn planted on ground not previously stocked with plant-louse eggs must escape at any rate until invaded from without by winged individuals of the second generation, and then, as a rule, it will be no more subject to injury than the other fields in its neighborhood. On the other hand, as the corn root-aphis has never been known to infest to an injurious extent any other crop following corn, there is very little probability that the escape of the corn will be balanced by damage to other crops.

We have many observations—the most important made in 1905—showing that fields of small grain following upon corn infested by root-lice the preceding year do not nourish these insects long but presently become clear of them, by what means is not yet precisely known. Indeed, the corn root-aphis seems unwilling to feed on the roots of the oats plant at all. Some individuals of the earlier generations, if originating in an oats field, may by acquiring wings go elsewhere and start fresh colonies, but many of even this relatively small proportion must be destroyed by the innumerable accidents to which these feeble and helpless insects are necessarily exposed. Rotation must consequently diminish to an important extent the number of corn root-lice in a neighborhood, and where it is the general practice to keep the same ground only a year or two in corn it is difficult to see how the root-aphis could ever become a very serious pest.

Applications of Fertilizers and Insecticides.—Various field observations have given us reason to conclude that fertilization of the soil will serve to support corn under the drain of aphis injury, especially by enabling a stunted plant to rally more rapidly and completely after the insects have begun to scatter. The rapidity and vigor with which, in rich ground and in a fairly favorable season, corn will outgrow an apparently fatal injury by the root-aphis is often surprising. Apart from this general statement I have only to report the result of a single series of plat experiments made in 1891 with various fertilizers mingled with petroleum, crude and refined, as an insecticide, and with applications of salt, wood ashes, and lime.

A plat of ground ten hills square, containing ninety-seven hills of corn, was selected on the university experimental farm at Urbana June 18, 1891, and surrounded by a continuous line of six-inch boards, sunk about three inches into the ground, with close-fitting joints and with the earth well tramped both outside and in. The upper edge of the boards was thickly covered with coal-tar, subsequently kept fresh by repeated applications. These measures were intended to prevent all interference with the experiment, either by escape of the insects within the plot or by invasion from without. June 26 this enclosure was enlarged to contain twenty-three hills more. Fertilizers and mixtures of fertilizers and petroleum were applied to the hills of corn June 18 and 23, being worked into the soil about each hill; and on June 26 lime, ashes, and salt were similarly applied. Of the ninety-seven hills in the first enclosure, forty-eight were found in the beginning to contain root-lice and ants, and of the twenty-three hills in the second lot sixteen were similiarly infested.

Three fertilizers were applied: superphosphates, muriate of potash, and sulphate of potash, each at the rate of three pounds to twenty hills of corn, and in each case half the hills under experiment were treated with the pure fertilizer and the other half with a mixture of fifteen ounces of petroleum to three pounds. One third of the above amounts were applied June 18—the petroleum in these cases being the crude Lima oil—and the remaining two thirds June 23, when refined petroleum was used. The following notes are condensed from the memorandum filed at the time by the assistant in charge of the experiment:

Experiment I. Superphosphates. Experiment II. Superphosphates and Petroleum.

June 29, I. Ants and root-lice numerous.
June 29, II. Both insects present but less numerous than in I.
July 1, I. Ants and lice abundant.
July 1, II. Ants present but no lice.
July 7, I. Ants and lice abundant.
July 7, II. A few ants but no lice.
July 15, I. Ants and lice comparatively abundant.
July 15, II. Ants and lice both present but fewer than in I.

Experiment III. Muriate of Potash. Experiment IV. Muriate of Potash and Petroleum.

June 29, III. A few ants and lice found.
June 29, IV. Dead plant-lice discovered in one hill, both ants and lice occurring generally but not abundantly.
July 1, III. A few ants but no lice.
July 1, IV. Ants alone discovered on roots about one foot from the hill, just outside the fertilized area.
July 7, III. Ants and root-lice found.
July 7, IV. Ants but no lice.
July 15, III. Ants plentiful; lice common.
July 15, IV. Few ants and lice detected.

Experiment V. Sulphate of Potash. Experiment VI. Sulphate of Potash and Petroleum.

June 29, V. Ants present but no lice.
June 29, VI. A few ants present but no lice.
July 1, V. Neither ants nor lice were found.
July 1, VI. A few ants and lice in one hill.
July 7, V. Ants and lice numerous.
July 7, VI. Both insects present.
July 15, V. No ants or lice detected.
July 15, VI. Small colony of ants and a few lice in one hill.

The weather during the period covered by the above experiment was generally dry, but abundant rains occurred June 20 and 21 which seemed to dissolve the fertilizers and wash them into the ground.

The lime, ashes, and salt experiments were entirely without effect, ants and plant-lice occurring abundantly in all parts of the plat treated throughout the entire period of observation to July 28. This plat served consequently as a check upon the preceding experiment.

Although the effect of the other applications seems from the above notes to be quite marked, the experiment is nevertheless indecisive, since the hills treated were not dug up when examined from time to time, but only searched as carefully as was possible without injuring the plants. July 28, when all the hills were removed, they seemed, according to Mr. Marten's report, to be about equally infested, all appearance of difference having then vanished. It will thus be seen that these experiments have little value except as hints towards future work. The differences observed may nearly all have been due to a repellent effect of the substances applied, in consequence of which the ants withdrew their charges deeper into the earth, with little diminution perhaps of the injury to the corn.

Breaking up Nests of Ants.—In one experiment, begun November 25, 1890, a strip of corn stubble three rods wide and ten rods long near the University premises at Champaign, was plowed six inches deep, half the strip being thoroughly harrowed also. The ants' nests among the corn hills were thus turned out and thoroughly broken up, except, that in a few cases the plow did not go the full depth of the nests, but left the bottom undisturbed. The harrowing knocked the dirt out of the roots of the corn and broke up the fragments of the nests remaining in the clods. April 18, 1891, when the ground was again plowed, five ants' nests were found in this plat and thirteen in an equal strip beside it. All of these outside nests contained ant larvæ of various sizes, while those inside the strip contained no ants but worker adults. Ten of the former lot of nests and three of the latter contained root-lice also, on smartweed roots.

In another precisely similar experiment, begun upon the same day in an adjoining field, a strip was plowed two and a half rods wide by twelve rods long, half of this being thoroughly harrowed, as before. The plowing averaged six inches in depth, but the plow ran considerably deeper under the corn rows, and the ants' nests were well broken up and scattered. April 17th of the following spring the ground was plowed for corn and thoroughly examined to determine the result of the experiment. The part which was harrowed contained three ants' nests, the remainder six; while on an equal strip adjoining, thirty were found. None in the strip plowed in fall contained young ants, while every one of those outside contained them. Several wingless females were seen in the nests, one of them in the plowed strip.

Neither the weather at the time nor that of the following winter was especially favorable to the success of such an experiment, the mercury reaching a maximum of 49 degrees F. on the day the experiment began, and the winter following—that of 1890-91—being unusually open and warm. Further, there had been more than a week of warm spring weather previous to April 18th, the mercury reaching 72 degrees on the 9th, 75 degrees on the 13th, and 77 degrees and 78 degrees on the 17th and 18th respectively—temperatures at which ants as active as the little *Lasius niger alienus* might well disperse themselves and begin new colonies in unoccupied ground.

These experiments afford, perhaps, scarcely a sufficient basis for a final conclusion as to the economic value of this method, but so far as they go they are most encouraging. If we compare the treated plats with the check plats beside them, we find (1) that the ants' nests in the former were less than a third as many as in the latter; (2) that all in the plowed and harrowed plats were destitute of ant larvæ while in the check plats all without exception contained such larvæ; and (3) that in the single plat first mentioned the ants' nests containing lice were less than a third as numerous as those in the plat outside.*

From the above we can only infer the disastrous effect of this late fall and winter plowing upon the ants themselves, and, presumably, also upon the plant-louse eggs they have in charge. It seems also quite probable that some, if not all, of the nests found April 18th in the experimental plats had been established there by worker ants in spring, and were not remnants of the nests previously broken up, and if this were the case the root-lice found in them had doubtless been brought in from without.

Starvation Experiments.—April 15, 1889, twelve young root-lice recently hatched were placed in a cavity in the moist earth, which was covered with a glass slip so placed as to allow an examination of the interior. April 20th two of these root-lice died; the next day half the lot were dead; April 22d only two were living; April 23d but one; and on April 24th, nine days from the beginning of the experiment, all were dead.

May 14, 1888, a number of corn root-lice of various ages, taken from the roots of young smartweed in the field, were placed in a glass vial with moist earth, the mouth of the vial being covered with gauze. On the 18th all were still alive, but by the 20th all had died, the earth in the vial still remaining moist.

April 30, 1890, a number of eggs were placed in a cavity in sterilized earth and left to themselves. May 1, one young louse appeared from the only egg of the lot which hatched, and May 3 this one was dead. It appeared from the foregoing that young of this species hatching in the earth and kept without food would die in from two to nine days.

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*By an unfortunate oversight no mention was made in the notes on the second experiment, of root-lice in either the plowed strip or check.

As a field application of this fact, an attempt was made April 16, 1889, to starve the young lice in the ground by keeping down the growth of young weeds. A piece of ground was thoroughly harrowed in two directions with a cutaway disk harrow, and the weedier parts of the plot, several times additional. April 20, however, ants and lice were found both within and without the harrowed strip; but the ants had no plant-louse eggs in their possession where the ground had been harrowed. The result of this treatment was not especially encouraging, the young weeds sprouting so freely and abundantly in the moist earth, to a depth of four or five inches, that it seemed impossible to reduce the food supply of the lice to any considerable extent by mechanical methods.

Our present knowledge of effective economic procedure for the corn root-aphis may be summarized in the form of the following recommendations: (1) That the fertility of the ground should be maintained as a general safeguard, and that cultivation should be so managed—especially that of the lower parts of the field—as to prevent so far as practicable the seeding of pigeon-grass and smartweed among the corn; (2) that infested corn fields should be plowed deeply and thoroughly and repeatedly stirred by means of a disk harrow, either late in fall, during some suitable winter interval, or in early spring previous to planting to corn; and (3) that a somewhat rapid rotation of crops should be systematically followed, corn usually being allowed to grow on the same ground but two years in succession. While some work remains to be done with reference to the precise value of these methods in practical application, there is no longer any doubt of their substantial usefulness, at least as a means of holding in check the injuries of the corn root-aphis.

ON THE ANTS ATTENDANT UPON THE CORN ROOT-APHIS.

(See Fig. 21 and 22, and the colored plate.)

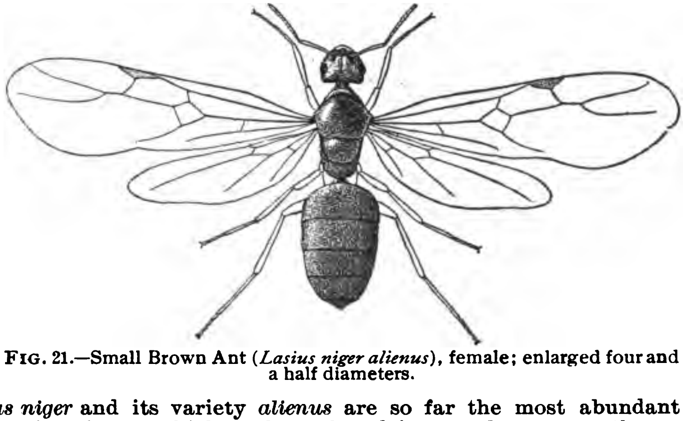

FIG. 21.—Small Brown Ant (*Lasius niger alienus*), female; enlarged four and a half diameters.

Lasius niger and its variety *alienus* are so far the most abundant of the seven species of ants which we have found in attendance upon the corn root-aphis that a discussion of the economics of this relation need scarcely take account of any other species; but as the most promising protective measures against this aphis are based on our knowledge of the life history and habits of this commonest corn field ant, an accurate account of the latter is to be desired. Our notes on this subject cover the entire period since 1883, and enable me to give a fairly complete history of this species throughout the year.

Life History.—The winged sexual forms, male and female, of this ant begin to appear each year as early as the latter part of June (the 21st to the 27th), hatching from pupæ which may have formed late in May (27th and 28th, by our notes). The emergence of males and females from the pupa continues throughout the season, certainly into October and probably to November, but the males perish before the winter. The females, however, having been fertilized and deprived of their wings, begin their separate excavations in fall, or continue with the workers in nests already established. There they hibernate, sometimes at least commencing to lay their eggs in fall, and living in spring through April and May.

We have found the eggs of this species only November 10, April 25 and May 20; but exceedingly small larvæ certainly very recently hatched have been collected by us May 5 to 19, July 15 and September 21. Our experiments have not, however, been conducted in a way to distinguish between eggs and young coming from fully developed females and those from fertile workers.

The larvæ hatching from time to time throughout the summer may be found as pupæ from the latter part of May through June, July, August, and September, to October 30, and even, according to a single observation made at Urbana, to November 20.

Haunts, Actions, and Habits.—The nests or burrows of this ant, in which these breeding operations are carried forward, are widely distributed in corn fields and grass-lands,—especially in the latter, along the borders of roads and paths,—and also under stones and boards, in and under decaying logs, and in an indefinite variety of situations. In corn fields they are established almost wholly in the hills of corn, and remain here among the old corn roots throughout the season. As this is the commonest and most generally distributed of all our ants in Illinois, an exhaustive list of its places of habitation would have little present interest. It has never been found by us to form large settlements, or making mounds or conspicuous structures of any kind, but simply scatters its little burrows almost indiscriminately, living in small families rather than in great colonies or city-like aggregations, and piling up only a small temporary heap of pellets around the mouth of its burrow. When its mines are explored they are found to consist of irregularly radiating and connected tunnels, rarely going to a greater depth than six or eight inches, or extending outward over a horizontal area of more than two feet. Here and there in their course or at their extremities and at various depths are chamber-like enlargements in which their eggs and young and the eggs of the corn root-aphis are preserved and cared for. Here also considerable collections of the worker ants are usually found,—especially in winter and in times of summer drouth,—and in these chambers the female resides and lays her eggs.

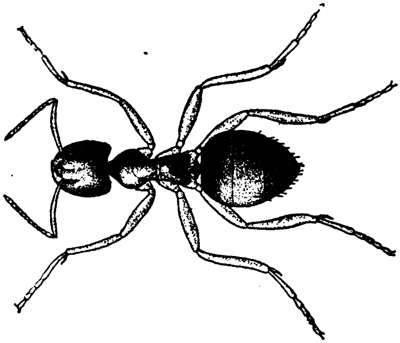

FIG. 22.—*Lasius niger alienus*, worker; enlarged eight and a fourth diameters.

In April, May, and June the workers seem to be most numerous and active. In July and August their activity declines, particularly in the hottest and dryest weather, although if nests be opened at these times the ants will be found in abundance. Again, in September, a period of bustling activity begins which continues until checked by the winter cold.

In ordinary winter weather of the milder sort, these ants are not absolutely motionless, but if disturbed crawl slowly and stupidly about, sometimes even painfully attempting to perform their usual duties of restoration and repair. We have not explored their nests in the coldest weather, when the ground is frozen to a considerable depth.

During the first warm days of spring the thoroughly awakened ants begin to open up their burrows to the surface, and carry their own eggs and young and the eggs of the plant-lice in their possession upwards and downwards according to the varying warmth of different layers of the soil. When the sun is shining brightly in the middle of the day they bring their charges to the more superficial chambers of their nests, or even expose them on the surface, but keep them farther downward at night and in cold and cloudy weather. The effect of this care upon the plant-louse eggs is shown by the earlier hatching of those cared for by the ants, and by the diminished number of those which fail to hatch at all.

Although this ant is evidently chiefly dependent for food upon the corn root-aphis and other plant-lice fostered by it, it is not strictly limited to this resource but, early in spring especially, has been found by us with freshly killed insects in its possession—caterpillars, carabid larvæ, and the like. Sometimes in midsummer also it resorts to animal food. July 16, 1884, in digging into a hill of corn infested by the root-aphis and this ant, I unearthed a carabid larva. This was suddenly attacked by one of the ants, which pounced upon it just behind the head. The larva struggled vigorously, but the ant soon fastened its jaws on the under side of the neck, just behind the head and a little to one side of the middle line. After this the struggle lasted only a few seconds, when the larva became completely quiet, and allowed this ant and another to drag it away without the least resistance. I watched this operation for a few minutes with a glass, and then put both ants and larva into alcohol. Although the larva did not visibly bleed when bitten, it was apparently dead, and did not struggle at all when put into alcohol.

June 2, 1891, an ant of the above species (*Lasius niger*) was found with a dead chinch-bug in a wheat field, and three others were seen dragging live chinch-bugs over the ground, one of which barely showed signs of life, a second of which moved its legs more vigorously, while a third, which an ant was dragging along by the beak, seemed scarcely at all disabled.

The Grass Root-louse.

Schizoneura panicola Thos.

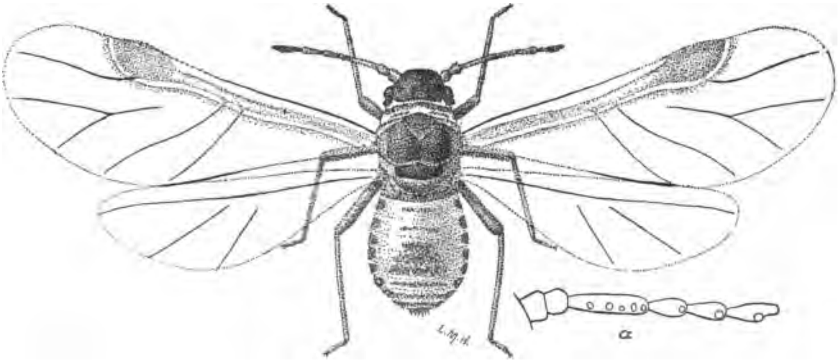

FIG. 23.—Grass Root-louse, winged viviparous female; enlarged eighteen diameters; *a*, antenna.

This species was discovered on the roots of *Panicum glabrum* and other grasses by Mr. H. Pergande, at St. Louis, Mo., in November, 1877, and first described by Dr. Thomas in 1879 in the Eighth Report of the State Entomologist of Illinois. The first observations of its occurrence in this State on corn were made in 1883, and it has been seen by us more or less abundant on the roots of various plants every year during the past eleven years. Its economic importance is but small, owing to the usually trivial numbers in which it occurs on corn, and the evanescent character of its attacks. It is often important, however, that the corn farmer should be able to distinguish it from the far more dangerous corn root-aphis—a matter of no difficulty to a fairly good observer. It may be told at once from that species by its white or yellowish color, and by the absence of the projecting cornicles or honey-tubes characteristic of Aphis, these being replaced in the present species by a pair of minute circular openings on the hinder part of the back, each delicately rimmed with brown and surrounded by a small dark patch.

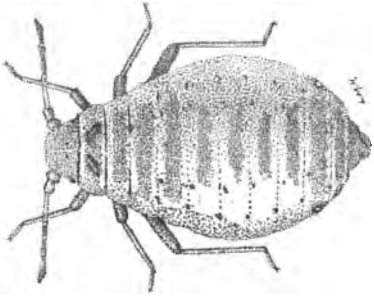

FIG. 24.—Grass Root-louse, wingless viviparous female; enlarged 29 diameters.

THE WHITE GRUBS.

GENERA LACHNOSTERNA AND CYCLOCEPHALA.

(Fig. 25-29.)

White grubs or "grub worms" are among the immemorial enemies of agriculture on both sides of the Atlantic, and in both Europe and America the problem presented by their injuries on the farm and in the fruit and vegetable garden still calls for thoroughgoing investigation and scientific treatment. In fact, the steady increase of their numbers in this State—probably connected with the gradual enlargement of the area laid down in grass—has made such an investigation of their life histories, habits, and economic relations simply imperative and indispensable.

They infest a great variety of plants, nearly all of which have an agricultural value, many of them being the great staple crops of the farm and garden. Grasses of every kind, all the small grains, Indian corn, potatoes, beets, and the root crops generally are liable to destruction by them, as well as strawberries and young fruit trees, young evergreens, larches, and young forest trees of various kinds.

Like most other injurious insects of the first class, they are liable to great variation and fluctuation of numbers in different localities and in successive years, sometimes getting the temporary mastery of a considerable tract, appropriating nearly its whole growth of vegetation to their own use, and then, within a year or two, disappearing from view for a time as an injurious agency. Apart from these seemingly spontaneous fluctuations of numbers, they are most likely to cause great loss when the crop on ground infested by them is changed by rotation from one affording them an abundance of food to one yielding a relatively scanty growth—as when grass-lands are planted to corn. A number of grubs which would produce no visible effect in a dense sward, may be sufficient to devour completely a field of young corn.

They hatch most commonly in grass-lands (although frequently also in corn) from eggs laid there by various kinds of beetles, all commonly confused under the general name of "June beetles," or "May beetles" or "dor-bugs." These large, thick, short, snuff-brown beetles, a half an inch to more than three fourths of an inch in length, nearly as thick from above downwards as they are wide, and about half as wide as long, are universally known because of their great abundance in May and June, during which months they fly at night, filling the air at dusk with their hoarse buzzing, and often invading lighted rooms in our houses, where they bump and bumble about, as awkward as frolicking cart-horses. In this stage the insects are but short-lived, the males dying soon after the sexes pair, and the females living but a few days after they have laid their eggs in the ground.

The young grubs hatching among the roots of grass or grass-like plants commence to feed at once, and live in the earth in the larva stage for at least two years (so far as known), most of them changing to the dormant pupa from the middle of June to September of the second or third year after hatching, and becoming fully developed "June beetles" again, still in the earth, in August or September of this same year. These beetles do not, as a rule emerge from their earthen cells until the following spring, but spend the winter at rest, each in the underground cavity made originally by the grub while preparing to pupate. In May and June they come out and pair and lay their eggs as already related. A single species (*Cyclocephala immaculata*) has a slightly different life history, the grub not pupating until spring. (Fig. 28 and 29.)

Our common and destructive white grubs all belong to the genera *Lachnosterna* and *Cyclocephala*, by far the greater number of species and individuals to the former genus, of which there are thirty-two species known to occur in Illinois. The genus *Cyclocephala*, on the other hand, contains but one species in this State. The life histories of these various kinds are not sufficiently different to make discrimination of species a matter of practical importance, and for economic purposes, consequently, the white grubs may usually be classed as one.

No satisfactory defense against them has yet been discovered, but in the contest with so abundant, so wide-spread, and so destructive an insect even imperfectly protective measures, or merely palliative ones, are worthy of the most careful attention. The practice of the farmers of the Old World, where a contest against closely related insects of like habit has been waged from time immemorial, is not usually applicable to American agriculture, but may nevertheless become so as conditions gradually change with the denser settlement of this country and a corresponding increase in the value of our agricultural products. I have consequently summarized the economic procedure of England, France, and Germany for the "cockchafer grub," the "*ver blanc*," and the "*engerling*,"—the names by which the European "white grubs" are known in those countries respectively.

INJURIES TO CORN AND OTHER VEGETATION.

The injuries of the American white grubs to corn may begin as soon as the roots of the young plant become large enough to attract the attention of a hungry insect, and may range—according to the age of the plant, the kind of weather, and the age and abundance of the grubs—all the way from a slight and temporary retardation of growth to an immediate and complete destruction of all the corn. An early loss of the tap-root exposes the plant to severe suffering by early drouth, and it is often so reduced in vigor from root injury that it fails to form brace roots at the proper time, and hence has so slight a hold upon the earth that it can not keep itself erect or recover itself after prostration by a windy summer storm.

In any case where the plant is yellowed, or dwarfed, or killed outright,—especially if these appearances be most marked on the higher, lighter parts of the field,—the presence of white grubs may be suspected.

As the roots of an infested plant are evidently eaten away, injury by the white grub is not easily mistaken for any other, and the presence of the conspicuous insects themselves, in the earth among or beneath the roots, will commonly confirm the diagnosis. If they are not thus found where other evidence points to them as the cause of the injury, they may frequently be discovered by digging down a foot or two in the worst-injured tracts.

As a fair illustration of the extent and general effect of a severe attack on corn, our observations of their work in a twenty-acre field near Champaign, Ill., are worthy of detailed report. This field of rich, black land had been heavily fertilized with straw-pile manure and seeded to timothy in 1884. It was pastured continuously until 1888, when it was left for hay, yielding a good crop of clean timothy that year. The sod was broken in the spring of 1889, and planted to corn May 10, immediately after breaking. The first planting was taken by web-worms and cut worms, but the second grew well, and promised an excellent crop until about tasseling time, when the owner noticed that much of the corn had a yellowish and unhealthy appearance, and that it blew down readily when the ground was wet. These fallen hills pulled up easily, and the roots had a stubbed appearance, as if cut off near their origin. A search in the earth where the corn had stood commonly yielded six to twelve white grubs to a hill. The crop on two or three acres of the highest land was a total failure, and the yield was light on the lower ground.

The following year (1890) the field was plowed April 28 and planted again to corn, although an abundance of grubs were noticed when the plowing was done. Several hundred were, in fact, collected by us April 28 for breeding-cage experiments, nearly all belonging to the species *L. rugosa* (Fig. 25, 26, and 27). An estimate based at this time on a count of the grubs found within the length of a rod in a 14-inch furrow, gave between 600 and 700 to the square rod, or at the rate of 288 pounds per acre. By the time the young corn was six inches high about two-thirds of it had been destroyed by the grubs. The field was not replanted, but about the 10th of June it was twice harrowed and sown to hemp. On account of the lateness of the season and a midsummer drouth the hemp did not grow well, and about 100 bushels of corn were finally taken from this twenty-acre field. July 26, in the part of the field which had been worst infested, but three grubs and a single pupa were found in digging with a spade twenty holes, ranging in depth from a foot to twenty-six inches. On the 1st of September a trench 4 feet long, 3 feet wide, and 2 feet deep was dug in this same part, with the result that only one adult June beetle and two long-dead larvæ were found. In another space 8 feet long by 3 feet wide two adults and a single living larva were dug out, all the foregoing being within a foot of the surface. In two large areas turned over at the margin of the worst-infested spot, two living larvæ and one adult were taken, the former among the corn roots and the latter about ten inches down.

From these field observations, and parallel extensive breeding operations in the insectary, we have reason to infer the transformation to the imago stage during the season of 1890 of the greater part of the white grubs in this ground.

In 1891 the entire field was sown to hemp; but in 1892, three years after breaking, it was planted again to corn and again heavily injured by grubs. August 25, a general survey of the field showed that no part was free from them, and that probably every acre had been injured more or less. The damage was most serious now on the lower ground, where a tract of about two acres bore only a few scattered stalks with ears. Most of the corn here had failed to tassel, and much of it had died when from eight or ten inches to about three feet high. Patches of a rod to two or three rods across on which the corn was dead or worthless were to be found in all parts of the field. Nearly all the foxtail-grass (*Setaria*) had also been killed, the roots being cut off just below the surface, and even the common purslane (*Portulaca*) was similarly destroyed. Most of the grubs were at this time within three inches of the surface, and were well scattered through the ground, being by no means confined to the hills of corn. In one selected area of four feet square, which included only two corn hills, eighty-one grubs were dug up, some scarcely beneath the surface, and none deeper than three inches. In another area of equal size, containing three corn hills, 136 grubs were found, twenty-one of them in a single hill. Here, however, a few had burrowed to a depth of six inches. The grubs were at this time apparently from two thirds to three fourths grown, the most abundant species being *L. rugosa*—the same as that of the previous years.

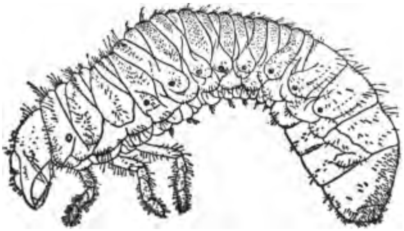

FIG. 25.—Grub of *Lachnosterna rugosa*; enlarged two and a half diameters.

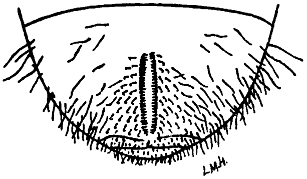

FIG. 26.—Last segment of grub seen from beneath; enlarged six diameters.

In addition to affording an excellent illustration of the destructive capacity of the common white grubs, this record is of special interest as evidence that *L. rugosa* at least will lay its eggs and breed abundantly in fields of corn. On no other supposition can we explain the appearance of such vast numbers of partly grown larvæ three years after the ground was broken from grass in the spring; three years, that is, subsequent to the latest time at which the eggs could possibly have been laid in the grass. It seems very likely that this second lot of grubs was hatched from eggs laid in the corn in the summer of 1890 by the beetles which came out of the ground in this same field. If this inference be correct, it follows that planting to hemp for a year will not clear the ground of grubs.

A somewhat similar inference of a readiness to breed in corn is to be drawn from our observations on another plat of about four acres on the university farm near Urbana. This field, broken up in the spring of 1890 and put into corn, was planted in 1891 partly to corn and partly to oats; in 1892 to oats and corn again, but with the areas reversed; and in 1893 to corn. On this the third year from sod, more than half the corn fell flat on the ground by the middle of September, most of the roots being eaten off by white grubs, of which three or four were commonly to be found in a hill. Owing to the consequent weakening of the plant the brace roots failed to form, the ears which set were small and very often imperfect, and a large percentage of the stalks were barren, the total height of the plant varying from six or eight feet to less than a foot. Even the tallest stalks were slender and unhealthy in appearance, the lower leaves, and sometimes practically the entire foliage of the plant, being as dry and brittle as in midwinter. Those stalks which had been killed early were usually so decayed as to be readily pulled apart at the nodes.

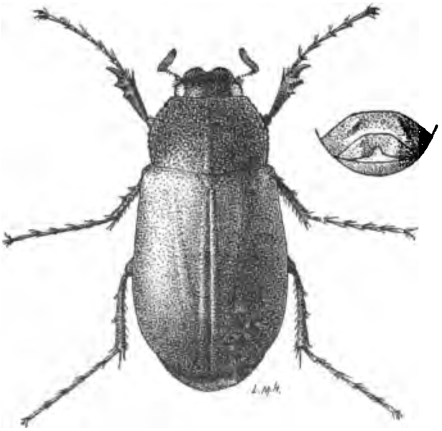

FIG. 27.—Beetle of *Lachnosterna rugosa*, male; enlarged two and a fifth diameters; *a*, last two ventral segments.

From these data we must conclude that the species concerned—which was either *inversa* or *fusca*—may live as a larva through four full years, making the entire life history cover a five-year period, or else that the eggs were laid later than 1889 in either corn or oats.

The white grubs taken by us in corn fields under circumstances to satisfy us that they either were or had been feeding on the roots of corn belong to eight species, as follows: *Lachnosterna fusca, tristis, inversa, hirticula, rugosa, gibbosa,* and *ilicis*, and *Cyclocephala immaculata.* Of these *L. fusca, inversa,* and *rugosa* are much the most common in such situations; and to them by far the greater part of the damage done to corn by the white grubs in central Illinois must be attributed.

Next to Indian corn, the crop most generally and seriously injured in Illinois by grubs is grass; and here the loss is more serious because continuous and usually unnoticed. A very large number of these insects may live their long lives in the sod, feeding steadily at the roots, and thus diminishing the yield without actually deadening any continuous area. It is only when through uninterrupted multiplication they become excessively abundant, or when severe drouth checks the growth of vegetation, that brown patches may appear in midsummer, sometimes merging in areas of an acre or more over which the turf, loosened by a destruction of its roots, may be rolled up like a carpet.

That they were original inhabitants of the wild prairie sod is shown by the common testimony of old settlers, and by Walsh in the "Practical Entomologist" (Vol. I., p. 60), where he reports that in 1845 he found white grubs eating off young corn when it was a foot in height, in a field broken from prairie land the preceding year.

Patches of wheat, barley, and other small grains may be similarly killed, all underground parts of the plant being completely eaten up; but clover is scarcely ever damaged to any considerable degree, and grubs are relatively rare in clover sod mixed with grass. Their injuries to potatoes have often been reported, and are generally well known, and they are among the worst insect enemies of the strawberry grower. In regions where the sugar beet is an important crop, they are among the chief injurious insects to be taken into account. Young larches and evergreens are sometimes killed by them in the nursery rows, and probably every kind of delicately rooted shrub and of young fruit and forest tree is liable to destruction by them.

No general list of their food plants has ever been prepared, and nothing whatever is known of preferences with respect to food among the different species of grub. That they may live for a considerable period on earth alone is shown by Dr. Riley, who says that he has known the larvæ of the common May beetle to feed for three months on nothing but pure soil;* and Professor Perkins, of Vermont, has kept individuals of all ages alive for weeks, and sometimes for months, in sand more free from organic matter than the soil of any field fit for growing crops.† The remarkable fact that the grubs may eat locusts' eggs in the ground has been mentioned in the First Report of the U. S. Entomological Commission (p. 305).

The beetles of the white grub feed most frequently on the leaves of various species of trees. Oak, hickory, ash, box-elder, elm, chestnut, butternut, black walnut, basswood, hackberry, hazel, willow, black locust, Carolina poplar, mountain-ash, tame and wild cherry, and pear are the species positively known by us, by personal observation, to be eaten by the adult beetles of various species; and apple, plum, Lombardy poplar, sweet gum (*Liquidambar*), maple, and birch may be added to the list on other authority. When a tree is much infested the leaves are eaten entire except perhaps a stub of the petiole, or the petiole, and a part of the midrib. Even the bark of the younger twigs may be gnawed away. Two species, *hirticula* and *fusca*, have been charged with almost wanton injury to the foliage of trees (oak and chestnut), done by gnawing through the leaf petioles without eating the leaves (Proc. Ent. Soc. Washington, Vol. II., p. 59), and we have noted the same habit as occasionally exhibited to some small extent in the "artificial forest" on the university premises at Urbana. The beetles sometimes eat the leaves of blue-grass also, and we have once found them feeding on heads of clover and once on corn. Several species have been known to eat the leaves of raspberries ("Insect Life", Vol. I., p. 366.)

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* St. Louis "Globe Democrat," March 25, 1876.

† Fifth Ann. Rep. Vt. Agr. Exper. Station (1891), p. 151.

These notes on the food of the beetles are of interest because of the damage sometimes done by these insects, especially to trees on lawns, during the brief period of their excessive abundance in May and June, but still more because it is in the adult stage that the white grubs are most susceptible to organized attack. If they are ever thoroughly mastered by the farmers of America, it will apparently be by concerted measures, possibly supplemented by legal requirement, for the destruction of June beetles before they have laid their eggs.

LIFE HISTORY AND HABITS.

The adult beetles of the more abundant genus *Lachnosterna*, hibernating in the earth in the cells where they originated, emerge in spring and early summer at periods varying according to the species of beetle, the general advancement of the season, and the character of the weather at the time. Warm and genial days in spring often bring them suddenly out in myriads where previously only scattered individuals have been seen, and their flight at night is of course more free when the weather is warm than when their energies are chilled by cold and storms.

As a rule, the males are not only the first to appear, but surpass the females in number, taking the season through., They also come to lights much more freely than the females, as is shown by a comparison of our collections made at lights with those made the same night from trees on which the beetles were feeding. The 7th of May, 1891, for example, a collection of *L. inversa* made with a lantern trap contained 1,210 males and twenty-four females—a ratio of fifty to one—while we took from trees the same night 122 males and seventy-three females—less than two to one. Taking all our collections of this species for the summer of 1891, we find that in those from lights (1,418 specimens) the males are to the females as fifty-one to one, while in those from trees (271 specimens) the ratio was one and one half to one. This is, however, much greater than the usual difference in other *Lachnosterna*, the species evidently varying with reference to their sensibility to light.

However taken and at whatever part of the season, it is rarely that the females exceed or even equal the males in the same collection. Throwing together 2,600 specimens of several species, taken at frequent intervals throughout the season of 1891, the sexes of which we have separated, it appears that the ratio of males to females at lights was 16.5 to 1, and from trees and various surface shelters (839 specimens) 1.3 to 1. My data on this subject may be conveniently exhibited in the following tabular form.

SPECIES.	Dates.	AT LIGHT.		ON TREES, ETC.	
		No. of specimens	Ratio of male to female.	No. of specimens	Ratio of male to female.
Fusca	April 18—June 4	94	2.2	193	1.3
Hirticula	April 29—June 24	185	4.6	352	1.3
Inversa	April 29—June 28	1,418	51.0	271	1.5
Tristis	May 7—	135	1.4	—	—
Gibbosa	May 15—June 24	42	13.0	20	2.3

The adult beetles emerging from the ground, flying about at night* in search of food, pair in the trees, to which they resort in myriads, and retreat again to the earth by day. Their first fight is made in the early evening, beginning at dusk as they pass from the ground where they have lain hidden by day to the trees on which they feed. With the advent of day they fly from the trees to the earth and hide themselves an inch or less under ground, or sometimes merely creep under fallen grass and other similar shelter.

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* A single species has been observed to fly by day in Utah. (Proc. Ent. Soc. Washington, Vol. II., p. 241.)

Particulars concerning this retreat to their hiding places at the dawn of day are given in notes made by Mr. John Marten and Mr. Philip Hucke, detailed for night-work on June beetles May 19, 1891.

3:45 a. m. Mr. Hucke reports the occasional dropping of a beetle from trees in the artificial forest (chiefly butternuts and hickories) where these observations were made. At 4:05, an occasional beetle still dropping to the ground without making any effort to fly. At 4:10 the air suddenly became full of flying beetles. One and then another began to make a buzzing noise with its wings, when, as if at a general signal, they deserted the trees in thousands, and by 4:25 everything was still again and nearly every one was gone.

Within the woods the beetles flew to a distance from the trees about equal to the height from which they started, the lower ones on the trees making a somewhat longer flight proportionately. Striking against the weeds and undergrowth, they folded their wings, and by 4:30 o'clock reached the ground within 100 feet of the trees from which they took their flight. Probably in a clearer place they would make longer flights.

The Egg.—Some of the species begin to lay their eggs in the earth early in June and this operation is in progress for about a month. The eggs are placed from an inch to three inches beneath the surface, each enclosed separately in a cavity just large enough to hold it, several, however, being frequently placed near each other, but never, according to our observations, in a common cell. There appears in no case any special preparation of the soil or chamber containing the egg, the statement commonly made to the effect that the eggs are laid in a ball of earth being clearly erroneous. The eggs are oblong-oval when first deposited, but soon swell by absorption to a nearly spherical form. The males begin to die not long after pairing, and the females also perish as their ovaries are spent. The eggs hatch in from ten to eighteen days according to our experiments. As the data upon which these statements are based are few, they may profitably be given in some detail.

Larval Period.—Our knowledge of the length of life of the white grubs in the larval stage is based solely upon inferences mostly drawn from the varying sizes of the grubs that appear in collections made at any given time. Since the eggs are all deposited practically within a month, and since the larva grows but slowly, difference in size due to variations in time of hatching must be but small. It is easily seen, however, from almost any large collection made in spring or early summer at one time and place, that grubs of the same species or group can be readily assorted into two lots differing notably in size, and never, so far as my observation goes, into more than two.* This is readily to be explained on the supposition that the larger specimens are two years old that season and that the smaller have hatched from eggs laid the preceding summer. Upon this supposition the *Lachnosterna* larva lives as a grub a trifle over two full years, changes to the pupa and imago at the beginning of the third year of its life and emerges from the earth an adult, prepared to lay its eggs at the end of this three-year period.

The growing grubs feed, of course, only during the season of growing vegetation, usually retiring from the middle to the last of November to a depth beneath the surface varying according to the severity of the winter weather, and coming up again within reach of food commonly some time in March or early April.

The time and place of hibernation have their especial economic interest, since while in their usual winter quarters the white grubs are far beyond the reach of any agricultural operations. The distance to which they retreat in this latitude is about a foot and a half, if I may judge from a single observation made Nov. 29, 1886, in a badly infested field of wheat in Sangamon county, Ill. Here, around the margins of denuded patches—the ground being frozen some four inches deep—the white grubs were found repeatedly in numbers averaging four or five to the square foot at a depth varying from a foot and a half to two feet. In 1890 they had already come up, in the pastures, from their winter quarters by the 24th of March; were still at the surface in their usual number during the latter part of October; and had not wholly withdrawn by Nov. 25—although at this last date most had gone beyond the reach of the plow. Notwithstanding this well-marked habit of retreat at the approach of winter, they occasionally linger at the surface and hibernate at a depth scarcely greater than that at which they are to be found during the summer season.

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* To verify this statement it is necessary that the observer should learn to distinguish species or at least groups of species of these insects in the grub or larval stage.

Pupation and Formation of the Beetle.—The full-grown white grubs, presumed to be two years old according to the preceding section, will live an active life in the earth, feeding freely from March to June or July, during which months they change to the pupa a few inches under ground, in oval cells made by the grub by turning about in the earth. In this smooth-walled chamber the cuticular remnant of the last moult will be found enclosed with the pupa—that is, the crust of the head of the grub and shriveled fragments of its last skin. Our first date for this pupal transformation of *L. inversa* is June 13, 1889, but Professor Perkins notes the pupation of two larvæ out of several hundred early in May. In this chamber they lie until August or September, when they change to the June beetle, *fusca* and *gibbosa* as early as Aug. 11, and others—at least individuals of *implicita*, for example—not before Sept. 17. A small percentage of the adults thus formed late in the summer and in early fall, may escape from the earth before the winter opens, but this is relatively a rare occurrence, the great mass of the generation continuing through the winter in the pupal cells within which they originated. They are to be found in winter from no more than two or three inches to about ten inches beneath the surface. Hence they escape in spring, as already described, pairing and laying their eggs for the generation following.

From the foregoing it will be seen that the white grubs of the genus *Lachnosterna* hibernate in two stages only, those of larva and imago, the grubs themselves representing at least two generations.

Cyclocephala. (Fig. 28 and 29).—The white grubs of the genus *Cyclocephala* differ from those of the various species of *Lachnosterna* in so far, at least, as to hibernate in the the larval stage, to pupate in May and June, and to emerge as beetles in June and July—later on an average than the species of the other genus. Pupation is consequently earlier than in *Lachnosterna*, and the emergence of the imago occurs later in the season, the essential difference being that adults of *Cyclocephala* escape from the earth one or two months after the completion of their larval life, while those of *Lachnosterna* continue in the earthen cells as pupæ and imagos about ten months. The difference in the economic application of these biographies is not, however, very great, since the period of active larval life of *Cyclocephala* seems to terminate on an average only three or four weeks before that of *Lachnosterna*. My detailed notes on the transformation of white grubs belonging to this genus are but few in number, but as they accord with those already given by entomologists they serve to support the common statements concerning the life history of these beetles.

Our only species in Illinois is *C. immaculata*, and its larvæ occur in grass with the other white grubs, and have been found infesting corn on sod.

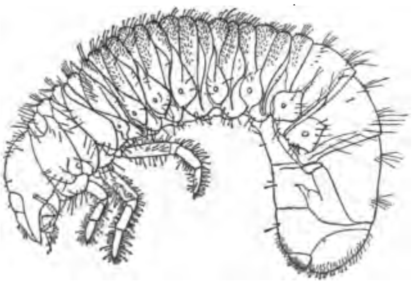

FIG. 28.—Grub of *Cyclocephala immaculata*; enlarged three and a third diameters.

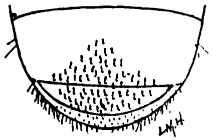

FIG. 29.—Last segment of grub, seen from beneath; enlarged six diameters.

PREVENTIVE AND REMEDIAL MEASURES.

If we use the word remedy for measures intended to arrest an injury already begun, and prevention for measures applied in advance of such injury, we must say that efficient remedies for the injuries of white grubs are but little applicable to their work in corn, and that we are confined consequently, for the main purposes of this article, to a discussion of preventive measures only. Such measures of prevention may be either local or general: applied, in the first case, to the field in which corn is to be planted, and intended to forestall injury in that field only; or, in the second case, applied elsewhere or more comprehensively, with a view to a more general effect in reducing the number of white grubs over a larger area.

Local preventive measures can take effect only on the white grubs themselves, while the most valuable general measures are those directed to the destruction of the June beetles before their eggs are laid.

Local Prevention.—It is now well settled, as has been shown in the preceding pages, that at least some species of the white grubs may be freely and abundantly bred in fields of corn; but it still remains true that by far the greater number of those in the country at any time have arisen from eggs laid by the beetles in ground bearing a crop of grass; and that corn is consequently much more likely to be damaged if planted on sod than if it follows clover, some small grain, or corn itself. The first effort of the corn farmer threatened by these insects should consequently be directed to clearing the grubs out of the grass-land which he wishes to plant to corn. For this purpose it is very desirable that hogs should be pastured for a considerable time on meadows or pastures before plowing for corn, and that they should also be given the run of the field while it is being plowed. This measure will be practically useless, however, under ordinary circumstances, if resorted to later than October or earlier than April, as in the interval between these months the grubs will be beyond the reach of pigs, buried in their winter quarters.

Further, I do not myself in the least doubt the great profit to the average farmer of providing for the collection of white grubs after the plow, by hand, in soil where they are particularly abundant, especially where any kind of cheap labor may be had. In estimating the value of this method, we should bear in mind the fact that a small number of grubs may do a great amount of harm to young corn on comparatively clean ground, because of the small amount of vegetation offered to them as food while the corn is young.

Next, we should take into account the relatively small damage done to clover by the grubs, and the further fact that we have no present evidence that the eggs of the June-beetle are commonly laid in clover land. It is consequently a good practice, so far as grub injury is concerned, to use a standard rotation of corn, oats, and clover in tolerably rapid succession, the ground continuing on none of these crops for more than two years together. It need hardly be said that a generous fertilization of the soil and thorough cultivation of the crop will diminish loss to corn by enabling plants attacked to throw out new roots more vigorously to take the place of those eaten by the grubs. Indeed, by some most intelligent and successful farmers, high fertilization and frequent rotation are regarded as a sufficient defense against these insects. Some of our observations show that June beetles are likely to deposit their eggs in the corn field from which they themselves have emerged, provided it offers them suitable conditions—a fact which makes it clearly inadvisable that a field injured by white grubs one year should be planted to corn the next.

General Prevention.—The principal and most effective preventive measures of general promise are those for the collection and destruction of the June beetles before they have laid their eggs. They are practically confined to the following four methods, mentioned in the order of their importance: (a) Shaking and jarring down the beetles at night from the trees in which they feed, and their collection on sheets or cloth-covered frames similar to those in use for the peach and plum curculio; (b) exposing light-traps early in the evening in places frequented by the beetles; (c) the spraying of trees to which they resort with Paris green or other suitable insecticide; and (d) the turning of pigs into woodlands, forest plantations, and the like, where the June beetles conceal themselves by day.

These are all measures calling for coöperative action by all, or at least the greater part, of the farmers of a neighborhood, since it is useless to expect any pronounced effect from isolated and individual action. They can only be carried out by previous agreement of those interested, by the offer of premiums for the beetles, or by the passage and enforcement of laws bearing equally upon all. In estimating the value of these methods it should be remembered that each female beetle is the average equivalent of a large number of grubs.

In illustration of the effectiveness of the first mentioned of these methods I quote from notes of Assistants Marten and Hucke, made in 1891:

May 19, 2:40 a. m. Shaking the trees in the university forest plantation made the beetles fall very easily, the second shake generally getting all, or nearly all, there were in a tree. Those shaken from the trees made no effort to fly up again, and only one such came to the lantern trap near by.

3:45 a. m. The beetles apparently as abundant as ever on butternut and hickory. The slightest shake of either of these trees brings down the beetles by dozens. Butternut trees six to eight inches in diameter drop them in considerable numbers when shaken by the hands—so easily are they detached.

From other notes it is apparent that the June beetles cling more closely to the trees early in the evening,—from 8:00 to 10:00 o'clock,—a fact doubtless to be connected with the gradually stupefying effect of the night dews and the cooler air towards morning.

This is the standard method in both France and Germany for the control of injuries by the European white-grubs. The results attained in the former country are shown by an article, "La Chasse aux Hannetons," published in the Revue de deux Mondes for 1878. In consequence of an offer of premiums for beetles in the department of Seine-Inférieure, 1,149,000,000 of these cockchafers were collected and paid for in that year, at an expenditure of $16,000. It was estimated that these beetles would have given origin the following year to 23,000,000,000 white grubs. The proprietor of an establishment for the manufacture of sugar from beets, whose crop was seriously affected by the ravages of the grubs, offered a prize of $4.00 for each 100 kilogrammes (about 220 pounds avoirdupois) of the beetles, and obtained as a consequence 28,000,000 cockchafers—equivalent to 560,000,000 grubs—the following year.

Details of the common procedure in France are given by A. Wallés in "Bulletin de la Société Centrale d'Apiculture et d'Insectologie" for June, 1890. "It would be a mistake," he says, "to wait until the cockchafers [English name for the European equivalent of our June beetles] have emerged, since the whole benefit of the capture of the beetles will be lost if the females are given time to lay their eggs. Measures for the destruction of these insects must be taken, consequently, from the time that a few begin to appear. Further, if in certain parts of the territory involved the capture of the beetles is neglected, the good effect of the procedure will be considerably diminished. These two points are essential and imperative.

"The cockchafer catchers should be provided with hooked poles, with an awning cloth, or the like, and with bags for their catch. It will be well for them to go in little groups, and to make their rounds from the time of the first appearance of the insect. This last observation is most important. On the 12th of May, for example, [in France] no more than 20 per cent. of the cockchafers captured in the trees will be females. A little later, on the contrary, the males will have disappeared, and scarcely any but females will be found. These, however, will have laid their eggs.

"The beetles may be most easily shaken down from the trees in which they are concealed at the dawn of day, when they are still stupid with the coolness of the night, and this is, consequently, the time at which these collections should be made. Two persons will do well to work together when tall trees are to be visited. One strikes the branches and shakes them by means of the hook fastened into the end of his pole, while the other picks up the beetles. They can, of course, change places occasionally. When there is grass under the trees a cloth must be spread to catch the beetles, which would otherwise often be lost. It will be very easy to clear trees of smaller size by shaking them energetically, but not violently enough to break them.

"It is perhaps in the canton of Mayenne that the cockchafer hunt is pursued by the inhabitants with the greatest method, energy, and perseverance. There those engaged in the chase of the beetles are divided into squads of four (men, women, or children), each of which is furnished with the following instruments: (1) A sheet of burlap three yards by two, in the ends of which two flexible sticks are fastened. Strings intended to support the apparatus are attached to these sticks. (2) A long pole armed with an iron hook. (3) A sack of coarse cloth. The squad being thus equipped, two hold the sheet extended under the branches. Owing to the flexibility of the rods at the end, the surface of the sheet easily takes the concave form of a common hammock. The branches are then shaken with the hand or with the hooked stick, and the cockchafers fall upon the cloth and accumulate in the center."

Between 2:00 and 5:00 o'clock a. m. is the best time for capturing our American June beetles. If they are thus collected in very great numbers they may be most conveniently killed by throwing them into tubs or barrels of water with kerosene on the surface. If the number is so great as to be likely to be offensive if left to decay, they may be scattered upon the fields as a fertilizer.

The foregoing method is but little likely to be brought into use on the scale required to make it effective unless the white grubs become, at least locally, more destructive than they are at present in any part of the State of Illinois. It is quite within the bounds of possibility, however, that this or some similar method will be ultimately forced upon the American farmer.

Our June beetles are strongly attracted by lights; a disposition which may be used for their destruction in fields. An apparatus consisting of a lantern suspended over a tub of water placed in or near trees or groves resorted to by the beetles will often collect large numbers of the adult insects, which, flying against the lantern, drop into the water, where they are readily killed if a little kerosene has been poured over the surface. This method is, however, of little value as compared with that above described, since it attracts males in very much greater proportion than females—sometimes fifty of the former to one of the latter. It is also ineffective on moonlight nights, and when the weather is cool or windy; is much more expensive; and, under the most favorable circumstances, less thoroughgoing. Its effect is shown by office notes made in 1888 and 1891. June 9 of the former year 127 beetles were caught in a pan fifteen inches across partly filled with water and kerosene, above which an ordinary lantern was suspended, the apparatus being placed on a bench under trees in Urbana, Ill. A similar experiment made May 7, 1891, with a tub of water and oil and a common kerosene lamp yielded 1,290 beetles, of which all but forty-one were males. In this case the trap was placed in a small forest plantation on the university farm in Urbana. These beetles were all taken between 7:45 and 9:15 p. m., after which only now and then one would come to the light. Later in the season no doubt the proportion of females to males would have been greater; but statements made in another part of this article under the head "Life History and Habits," show that the disproportion continues throughout the season.

The spraying of trees most resorted to for food is a possible measure, since the beetles are killed by arsenical poisons—a fact demonstrated by laboratory experiments made by us in 1888 with oak leaves dipped in Paris green mixture, one ounce to twenty gallons of water. The expense of a general application of such an insecticide will, however, prevent its common use.

When pigs can be turned in May and June into groves, orchards, or forests infested by the beetles, they cannot fail to destroy immense numbers of them, since they eat them eagerly, and can easily find them, hidden as they commonly are by day barely under the surface of the ground. This is a measure only occasionally applicable.

Remedial Measures.—Direct remedies for the attacks of white grubs are either inapplicable to the corn field, are of doubtful economic value, or are too little understood as yet to make them worthy of recommendation. For example, kerosene emulsion may properly be applied to infested lawns, and if followed by a copious watering may kill large numbers of the grubs, but he cost of this material and treatment will preclude its use against grubs in corn; and kainit and other potash fertilizers (the sulphate especially) will destroy grubs in the earth, but for this purpose must be used at a rate inadmissible in farm practice—more than a ton per acre according to Professor Perkins (Fifth Ann. Rep. Vt. Agr. Exper. Station, p. 152).

Among remedial measures of uncertain value may be mentioned the cultivation and dissemination of the fungus parasites of the white grub—uncertain because not yet thoroughly tested, and because such tests as have been made do not demonstrate the practical utility of the method.

These parasitic fungi do, however, sometimes spontaneously destroy immense numbers of white grubs in the field, and some of them can be easily cultivated in quantity outside the body of the insect—almost as easily as mushrooms may be grown for the market. The subject of the fungous diseases of these insects is therefore a very suitable one for investigation and should undoubtedly be most thoroughly studied from every point of view.

THE GREEN JUNE BEETLE.

Allorhina nitida L.

The larva of the green June beetle, *Allorhina nitida*, commonly known as a white grub where it occurs, is distinguishable from the species of *Lachnosterna* and *Cyclocephala* by its somewhat larger size when full grown; by the thick covering of short stiff hairs easily visible to the naked eye; but especially by the difference in its method of locomotion upon a hard surface. The common white grubs (*Lachnosterna*) creep only by means of their legs, dragging the heavy abdomen clumsily along; but the larva of the green June beetle, when thrown upon a hard surface, turns immediately upon its back, and moves somewhat easily in this position by alternate contraction and expansion of the segments of the body, using the stiff hairs upon the back as an aid.

This is a southern species, and in the Southern States largely replaces *Lachnosterna*, its larva being there known as *the* white grub. In central Illinois it occurs but rarely, but becomes noticeably abundant in the southern part of the State, where it has been occasionally reported as injurious in a small way. Although it has not been found in corn fields, its food and habits are such as to make it altogether likely that under favoring circumstances it might injure corn in the same manner as the *Lachnosterna* larva—or rather as the larva of *Cyclocephala*, which it more closely resembles in its life history. The grub is normally a grass insect, but infests likewise strawberry fields, and has been found by Dr. Riley to feed in confinement upon the roots of wheat. It seems to be less dependent upon living vegetation than even the white grubs, apparently living much more generally upon a rich soil. Indeed, the beetles seem to be attracted to manured land when about to lay their eggs, or to that which has been heavily mulched or contains an unusual amount of decomposing vegetation. Townsend has found them living in clean earth under circumstances to indicate a carnivorous habit.

The life history of this insect is, as already intimated, different from that of *Lachnosterna*, especially in the fact that pupation of the larva takes place in May, the beetles issuing in June. Its length of larval life is not known, nor the precise time or place of oviposition.

THE SOUTHERN CORN ROOT-WORM.

Diabrotica 12-punctata Oliv.

(Fig. 30-33.)

Injuries to corn by the southern corn root-worm have not been seen by us in northern Illinois and but rarely in the central part of the State, but they are more likely to occur southward. Outside this State they have been recognized by entomologists in Ohio, Indiana, Kentucky, Arkansas, Mississippi, Louisiana, Alabama, South Carolina, Virginia, and Maryland. As the beetle occurs from Canada southward through the Atlantic region, and thence to Minnesota, Kansas, Louisiana, and Mexico, it will probably be found much more generally present in corn fields than the above report would indicate.

Its injuries are very similar in general character and effect to those of the much more abundant and better known northern corn root-worm (*Diabrotica longicornis*) with which they have doubtless frequently been confounded. They are distinguishable with some difficulty from those due to the various species of wireworms, and it will often require the recognition of the larva itself to determine positively to which of these two classes of insects a given root injury is due. The presence of this root-worm in the field gives origin to the usual general effects of the loss of roots by the plant, varying according to the age of the corn, the gravity of the injury, and the kind of soil and weather. A conspicuous damage, noticeable on a casual inspection, may vary from the death of the plant to a slight retardation of its growth or to a general spindling, yellowish, and unhealthy look.

In the young plant about six inches high, the characteristic perforations of the stalk under ground may result in the sudden withering of the whole plant, or, more commonly, in the killing of the central leaf or tuft of growing leaves —an appearance which has given to this insect the common name of the "bud-worm" in some of the southern states. In certain instances the plant has been killed, as in Maryland, almost as soon as it has sprouted.

As the season advances, the corn in affected fields is likely to be uneven in size, and later, as the plant becomes top-heavy with growth, it may fall to the earth when the soil is softened by rains, and especially during windy storms. Having once so fallen, it will, if badly injured, fail to rise again; and it may further be seen that the plant has but little hold upon the ground, a whole hill, perhaps, being readily pulled up with one hand. As a consequence of the loss of roots and the general weakening of the plant, many stalks fail to set the ear or form only a nubbin. The injured plant also matures slowly, remaining green longer than the average, and being thus especially subject to injury by frost.

A closer examination of the young plant will commonly show a perforation of the underground part of the stem either at or near the upper circle of roots. Later, as the corn plant increases in size, the roots themselves are seen to be gnawed irregularly, great holes or notches being eaten out, first in one direction and then in another, until the roots are severed or consumed. In the larger roots the larva may perhaps completely bury itself, but it is much more likely to eat in and out irregularly than is the smaller northern corn root-worm presently to be described. It differs from this last species likewise in the fact that it commonly devours everything as it goes, leaving little or or refuse in its burrows; and in the further fact that it works all along to some extent in the base of the stalk, which it penetrates, but not deeply, finally causing the stalk to blacken and rot where water gets admission to its injuries. Its attack on corn is also earlier, briefer, and much more vigorous and destructive, owing to the larger size of the larva and its more rapid growth and earlier maturity. Even in well grown corn it very commonly bores into the stalk beneath the upper circle of brace roots, or behind the sheath of the lower leaf—habits in which it differs from the northern corn root-worm.

Search for this root-worm should be made in or about the injured parts— from the middle of May to the middle of August in the latitude of the southern half of Illinois. It is a soft, slender-bodied, worm-like insect, a little over half an inch in length when full grown, and nearly ten times as long as thick. The surface is slightly wrinkled or warty, white when young, and yellowish when old. The head is dark brown, sometimes nearly black, and there is a pale brown leathery patch on the top of the segment next behind the head, and a nearly circular similar patch on the top of the last segment of the body. The legs are very short and small, and the skin bears only a few long scattered hairs.

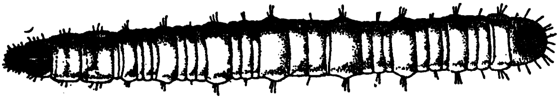

FIG. 30.—Southern Corn Root-worm, dorsal view; enlarged five diameters.

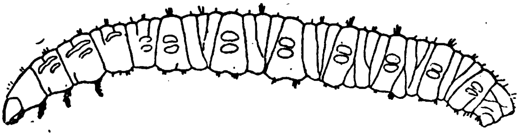

FIG. 31.—The same, side view.

It seems most likely to attack early planted corn, and hence in the Northern States has been found most frequently in sweet corn. An injury of 50 per cent. is a not unusual effect of its presence in southern Illinois, and elsewhere it has been reported as sometimes destroying almost every hill when the corn was young.

This corn root-worm has not been taken in the act of injury to the roots of any other plant than corn, but has once been seen eating off a stem of young wheat in fall.* Lugger found the pupæ among the roots of a common prairie plant, the cone flower (*Rudbeckia*), but says nothing of injury to that plant; and my assistant, Mr. Marten, reports the occurence of young larvæ among the roots of *Cyperus strigosus* and *Scirpus fluviatilis*—two sedges common in moist low-lands, the roots of which presented the same appearance of injury as those of infested corn.

The food of the adult *Diabrotica 12-punctata* is widely varied, apparently much more so than that of the northern *Diabrotica*. It has been for a long time commonly known as a squash beetle, eating both leaves and green fruit of squashes, melons, and cucumbers. We have seen it eating into pumpkins, sometimes to a depth of half an inch, and feeding upon clover blossoms and upon the leaves of tame and wild sunflowers (*Helianthus*). We have found it in May eating away the edges of the leaves of young corn in the field, and in July and August making small round holes in corn leaves in our breeding-cages. In September and October it has occasionally been taken from the tip of the ear of corn, feeding on the silk, and once in August we saw it gathering up fallen corn pollen. It has also fed upon ragweed leaves in our breeding-cages in August. By other observers it has been reported to feed on the petals of various flowers, including roses, dahlias, cosmos, and the cotton plant; upon young volunteer oats (December) on certain moulds, on the horse nettle (*Solanum canadense*,) on cabbage, cauliflower, and beans; and on the leaves of plums, cherries, apricots, and raspberries. Webster has also seen it eating unripe kernels of wheat and corn.

LIFE HISTORY.

As is very commonly the case with American injurious insects, the life history of this beetle is incomplete. Our studies of it are deficient not only in continuity of experimental work, but even in a number and distribution of observations and collections sufficient to give us a fair ground of probable inference. We are especially uncertain as to the number of broods and the stage or stages of hibernation. In the latitudes of central and southern Illinois it seems most likely that this is a two-brooded insect, but, if so, data published from Alabama and Mississippi would make it extremely probable that it is three-brooded there. Webster's observations in Indiana would lead us to suppose that it hibernates as an adult, he having found it feeding upon volunteer oats as late as December 14, and abroad in spring as early as April 17, at which time the sexes appeared *in copula*.

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* Webster, in Bull. 45 (1892), Ohio Agr. Exper. Station, p. 203.

Our own voluminous collection records of the adult do not clearly bear out the suppositions made above concerning the hibernation and the number of annual generations of this species. Without ever having made any special search for it, I find that we have actually obtained it in eighty-two collections—mostly of a miscellaneous character—ranging from April 20 to November 15. We have thus taken the imago once in April, six times in May, eight times in June, sixteen times in July, twenty-eight in August, eighteen in September, four in October, and once in November—a gradual rise in frequency from April to August, and a similar gradual decline thence to the end of the season. In our special collections of hibernating insects this species has not appeared; and in our large electric-light collections, made from May to September in 1886 and 1887, it occurred infrequently, and in no case until July.

As we now understand the subject we may say that in the latitude of the southern half of the State the eggs are laid in May and June, that the root-worms do the greater part of their mischief also in these months, pupating from the middle of June to the last of July, and yielding the beetle in July and August. The new generation commence to pair by the beginning of the month last mentioned, and young larvæ of the generation following may be found early in September.

I need only add that the eggs are placed, either singly or in groups of two to twelve or more, according to Riley's observations, below the surface of the soil near the plants, in cracks or immediately about the base of the plants.

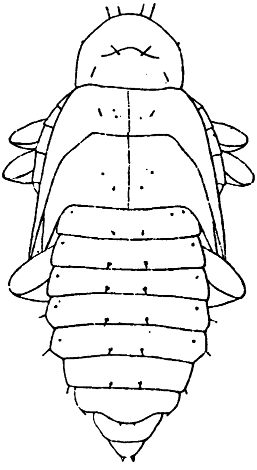

FIG. 32.—Pupa of Southern Corn Root-worm, dorsal view; enlarged ten diameters.

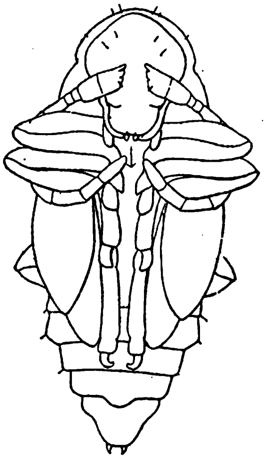

FIG. 33.—Ventral view of same.

NATURAL ENEMIES.

So far as known, the most effective natural check on the multiplication of this insect is a bacterial parasite (*Bacillus rufans*) observed by me to infest the larva, killing about three fourths of a considerable collection of these corn root-worms brought from Jacksonville July 19, 1889. We do not yet know what part of the larva is first attacked by this bacillus, but by the time the resulting disease has reached a fatal stage, it swarms in all the fluids of the root-worm, which have become practically a pure culture of this bacterial species. Infested larvæ lose their characteristic yellowish tinge, becoming gray and somewhat swollen, and after death they change color through pinkish to dull, dark red, the internal organs breaking up to a fluid pulp, held for a considerable time in the tough cuticle of the dead larva. The fluids of such specimens have a milky appearance in the pale worms and a reddish tint in the others. This last color is due, not to the color of the bacilli themselves, but to an excreted coloring matter diffused through the fluids in which they grow. In artificial cultures consequently—a number of which I made in 1889—a similar color is imparted to the culture medium, whether this be solid or fluid.

I have discovered no insect enemy of this species, but Dr. Riley reports the rearing of two dipterous parasites of it; one from the larva and pupa, and one (a tachinid) from the beetle. Prof. H. Garman notes the occurrence of small numbers of predaceous beetles and larvæ in summer and fall with young root-worms in the earth. He also mentions some internal parasites of the imago—*Gregarinæ* and nematoid worms.

Notwithstanding the abundance of the adult *Diabrotica* and its general distribution upon a great variety of plants, it seems but little noticed by birds. It has occurred but once in my own studies of the food of birds (in July, eaten by a catbird), and was not once recognized by Dr. Riley's assistants in their studies of the contents of the stomachs of 102 English sparrows which had eaten insects.

REMEDIAL MEASURES.

Until the life history of this species is better known, measures of prevention or of remedy can scarcely be intelligently discussed. The fact that its injuries to corn occur without apparent reference to the crop of the previous year makes it unlikely that the favorite method of rotation will serve for the protection of corn against this species. According to the scattered observations hitherto reported, sweet corn seems to be much more liable to injury than the field varieties, from which fact we may surmise that the time of planting has something to do with the intensity of the attack. The vicinity of cucumbers, squashes, and other of the commoner food plants of the beetle may, however, account for this seeming preference.

THE NORTHERN CORN ROOT-WORM.

Diabrotica longicornis Say.

(Fig. 34-37).

The northern or common corn root-worm (*Diabrotica longicornis*) is by far the most destructive corn root insect dependent on that plant alone. Indeed, it now seems likely that if it were not for the fact that it is highly susceptible to a measure of prevention which farmers have very generally taken unconsciously as a part of sound agricultural routine, it would long ago have seriously threatened the profitable continuance of corn culture in the very part of the country best adapted to that great crop. Even as it is, its injuries are undoubtedly to be reckoned by millions of dollars annually,* although the essential facts concerning its ravages and their ready and complete prevention were officially and widely published nine years ago.†

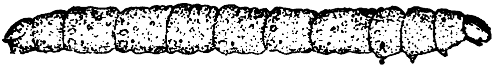

FIG. 34.—Northern Corn Root-worm; enlarged six diameters.

INJURIES TO CORN.

The presence of this insect first betrays itself in badly infested fields when the plant is a foot or so high. If at this time patches of corn are observed which seem to be standing still, so that the plants adjacent leave them behind, giving the field an uneven appearance, it is possible—especially if the field has been in corn two years or more preceding—that this retardation of

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* Webster estimates the damage to corn in twenty-four counties of Indiana in 1885 a $2,000,000, basing this judgment on a loss of $16,000 by one large farmer, and on his personal knowledge of its distribution and abundance in that State.

† Twelfth Rep. State Ent. Ill., pp. 29, 30.

growth is due to the presence of this corn root-worm. In this case, if the corn be pulled up many of the larger roots will be seen to be short and stubbed and rotten at the ends. On others a deadened brown line will be found, running irregularly lengthwise, while still other roots may be dead their whole length. Possibly when the earth is shaken off a slender white-grub will be discovered, two fifths of an inch long and about as thick as a pin; but more frequently the observer must carefully split or peel some of the affected roots, when a slender sinuous brown burrow filled with excrement will be exposed, running from one end of the root to the other, usually with the root-worm just mentioned somewhere in its course. This grub is white except the head, the top of the first segment of the body, and a little patch on the last segment, which are yellowish brown. The body is smooth and cylindrical, the head is short, deep, and rounded, and the tip of the body is also bluntly rounded off, somewhat like that of a common grub. These last characters will serve to distinguish it from small wireworms which are often found in such situations, but which are usually flattened from above, especially at the head, while in them the end of the body is commonly more or less toothed or notched or pointed. The grubs or larvæ of several small flies will often be found about the roots of corn, and careless or unskilled observers have occasionally mistaken these for the corn root-worm, but this latter insect has six short legs on the three segments just behind the head, while the grubs of flies are footless. We have seen as many as fifteen or twenty to a hill, and I do not doubt that in fields heavily attacked they are much more numerous. As the root dies, however, it is forsaken and another is attacked, until, not infrequently, almost every root will become infested as fast as it puts forth. This damage may thus extend to the practical destruction of the entire root growth, and the consequent death of the plant; or it may remain miserably dwarfed—six inches, perhaps, when other plants measure four or five feet. If the stem is perforated above the roots, the injury is probably due to the southern root-worm or to some of the species of wireworms, which can only be told by finding the insect itself.

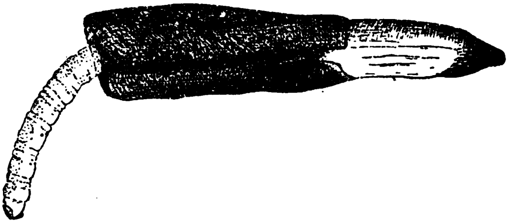

FIG. 35.—Corn root broken across to show Northern Corn Root-worm within.

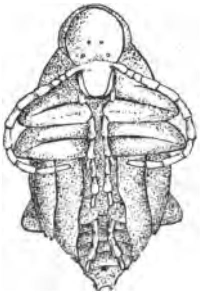

FIG. 36.—Pupa of Northern Corn Root-worm; enlarged 8½ diameters.

Attention may perhaps be first attracted when the corn is putting forth the silk, by the extraordinary number of barren stalks upon which no ear is forming, or stalks may be seen which have scarcely life enough to tassel. It may also be observed that the corn is unaccountably late, looking evidently greener and younger than other fields which had no advantage at the start. Or injury may be first suspected during a period of drouth, patches here and there, or the entire field, suffering unduly from this cause. The most conspicuous evidence of this injury, however, at this stage of growth, is the prostration of the corn after a soaking rain with wind, and the evident inability of the plant to right itself. If one of the worst-affected stalks be pulled up, the observer will notice that the roots are few in number, that many of them are withered and brown, and that others are rotted away to stubs. In these discolored roots the minute brown burrow of the insect may usually be detected, and the corn root-worm itself may often be exposed. A minor attack frequently has the effect so to retard the ripening of the corn that it is not ready for the earliest frosts, and the ear consequently remains soft and unfit for use; or the loss of roots may have diminished the size of the stalk and ear, leaving a small nubbin where a full ear might have been expected.

The injury continues from about the first or the middle of June to the last of August. As some of the larvæ mature and cease their work in the latter half of June, and others not for two months later, plants once infested may be freed of the attack, at least in part, by the pupation of the root-worms, and others, spared at the beginning of the season, may become infested later. It has sometimes been observed that large, rank stalks which did not ear out had evidently been injured after the corn had begun to tassel; while others, which leaned over at the root and then grew erect, had been infested earlier in the season, but had thrown out new roots after the root-worms had matured.

It is a matter of common observation that injuries by this insect are most noticeable during dry years and upon the higher parts of the field. We have no evidence, however, that the corn root-worms themselves are more numerous at such times or in such situations, and the greater injury may be due simply to the diminished ability of the plant to withstand attack. I have, in fact, seen vigorous and flourishing hills of corn badly infested during wet seasons with no visible effect upon their growth, even the larger burrowed roots remaining fresh and efficient, notwithstanding the injury.

In case no retardation of growth or damage to the crop has been observed. less conspicuous mischief may often be indicated by the great abundance in the field, late in July and in August, of a small grass-green beetle about a fifth of an inch in length, resembling in shape and general aspect the common small striped squash-beetle, to which, indeed, it is closely allied. These beetles are most likely to be seen clustered at the tip of the ear and feeding upon the young silk. or lurking at the base of the leaf where it joins the stalk, feeding there upon the fallen pollen of the plant. They should also be looked for upon the blossoms of ragweed, smartweed, and other plants in bloom among the corn. This is the adult insect to which the corn root-worm. so-called, has given origin, and its presence in extraordinary numbers in any field of corn is presumptive evidence that the plant has suffered earlier considerable root injury of the character above described.

It is very rarely that these phenomena are to be observed on ground not previously in corn, although sorghum and broom-corn have been found somewhat favorable to the development of this insect. It is only where through neglect it has become enormously abundant in a field that we may anticipate its escape from the corn in very large numbers before it has laid its eggs, in which event corn not succeeding corn may possibly suffer the following year.* The general damage to a field is in the worst cases sufficient to destroy the crop so far that the disgusted farmer turns his pigs into his corn to get what they can, and makes no attempt to harvest his crop. A badly infested field was described to me by Dr. Boardman in 1882, which is worthy of mention as illustrating one of the common effects of root injury by this beetle. "I should say," he writes, "that one fourth of the corn in this field was rotting or beginning to rot. I found, on cutting an ear open, that I could slice the cob as easily as if it were a turnip. The infested corn [in Stark county] is yielding from ten to fifteen bushels per acre."

Although the corn root-worm beetle is distributed throughout the Mississippi Valley, and south even to Central America, it clearly becomes comparatively rare southward, and has never been taken by us in southern Illinois in any numbers, nor found injurious in the larval stage except in the northern twothirds of the State.

This root-worm has not heretofore been certainly found infesting any other plant than corn, and the amount of skilled attention which has been given to this point by entomologists and other accurate observers, makes it practically sure that it is so closely limited to corn at the present time in Illinois that we may base our economic methods upon the supposition that it infests no other plant.

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*As an example of this tendency to spread from the infested field, I may note the not uncommon occurrence at Rankin, Ill., July 1, 1887, of this corn root-worm in a field of corn following oats, but only on that part of it which bordered an infested field in corn the previous year. It is possible that other instances of this kind reported previous to 1891 may have related to the southern corn root-worm, *Diabrotica 12-punctata*.

FOOD OF THE BEETLE.

The beetles, beginning to appear in June and continuing until November, feed entirely during this whole period upon the softer and more delicate parts of the vegetation present at the time. They collect the pollen from the tassels of the corn, or gather that which has sifted down among the leaves and collected at their bases, where these join the stalk. They also gnaw away the fresh silk from the tip of the ear (where they may often be found congregated in numbers of a dozen to twenty or more), probably thus doing a considerable amount of mischief by destroying the silk before it has served for the fertilization of the grain, and causing thus a partial blasting of the ear. They often eat the pollen of smartweed and ragweed among the corn, and outside the fields are very abundant upon thistle blossoms, and likewise upon heads of red clover, the pollen and petals of which they feed upon. By Professor French, of Carbondale, Ill., they are said sometimes to infest the bean plant; Dr. Boardman, of Stark county, reported them as abundant on cucumber and squash vines; and we have repeatedly seen them late in the year (Oct. 11 to Dec. 16) gnawing into ripe pumpkins in the field, eating through the outer hard coat, and burying themselves in the pulp to a depth of nearly half an inch. We have found them feeding on flowers of *Helianthus*, goldenrod, and other *compositæ*, and on the pollen of sorghum and of squash; and Professor Webster has seen them on the blossoms of the cotton plant. A farmer in DeKalb county asserts that they eat the pulp of apples where the skin has been broken from some other cause, enlarging such injuries so as seriously to damage the fruit. This same fact was reported to me some years ago from Grundy county, by Mr. O. B. Galusha, then secretary of the State Horticultural Society, thin-skinned apples apparently suffering worst and, acording to the judgment of my informant, being thus injured without the assistance of other insects. They have been repeatedly detected by us beneath the husks of ears of corn where the tips had been exposed or injured by birds or grasshoppers, feeding here on the broken grains. In one instance the beetle had apparently made its way through the husk itself, and was feeding upon the soft grains beneath. By Professor Burrill, of the University of Illinois, it was found in 1889 (Sept. 30) feeding upon a fungus belonging to the genus *Phallus*; and I demonstrated by dissections in 1882 the fact that it sometimes feeds largely on the smaller fungi—blights, rusts, etc.*

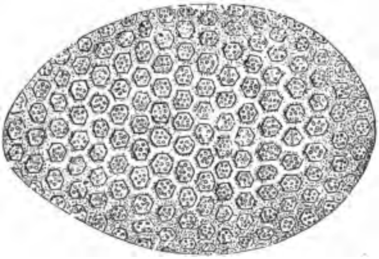

FIG. 37.—Egg of Beetle of Northern Corn Root-worm; enlarged eighty diameters.

LIFE HISTORY.

This species is single-brooded, as far as known. Although a few beetles may occasionally linger late in open winters,—to Dec. 16 of the present year (1892) for example,—and as a rare exception may even pass the winter alive, the species hibernates almost invariably as an egg in the earth.† As a rule, which is so far as known practically without exception, these eggs are deposited in fields of corn and hatch there the following spring—at just what date has not been precisely ascertained. The larvæ have first been detected in central Illinois June 10. They were found by me less than half grown near Polo, in northern Illinois, June 14, 1883. As the beetle was reported by an excellent observer (Dr. E. R. Boardman) to have occurred one season in southeastern Iowa as early as June 25, some larvæ must hatch by the beginning of that month. Pupation can scarcely begin later than June 20 if Dr. Boardman's date for the beetle is correct, and the same observer reports the finding of the pupa itself in the earth June 29. On the other hand, larvæ ready for pupation have occurred in our collections as late as Aug. 26—giving a period of something over two months for the pupation of an entire generation.

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*Twelfth Rep. State Ent. Ill., p. 23.

†I have in my office collection two specimens (one male and one female) obtained March 14, 1883, at Normal, Ill., with a quantity of miscellaneous insects collected from their hibernating quarters. On the other hand, beetles collected from pumpkins at Urbana Nov. 2, 1892, and placed in breeding-cages with pieces of pumpkin as food, had died in large numbers by Nov. 20; a few were still alive Dec. 4; two remained Dec. 17; but Dec. 28 all were dead.

The extreme dates definitely fixed for the next transformation—the emergence of the beetle—are June 25 for the earliest and not later than Aug. 31 for the last,—again a period of something more than two months. We have seen the beetles copulating at various dates from July 19 to Sept. 25,—an interval of two months and six days,—observations which probably fix approximately the beginning and the end of oviposition. The eggs, however, were not all laid by Oct. 1, 1882, as I determined by dissecting females at the time. For the present we may assign Aug. 1 and Oct. 5 as the average dates for the first and last deposit of eggs.

The recognition of this eight or nine weeks' period for the passage of the whole of a brood from one stage to another, enables us to say with some assurance that the eggs laid during this long interval in one year will hatch through a corresponding interval the year following—approximately from May 15 to July 15, or a little later. While these dates are some of them inferred, there is no doubt of the extension of each stage of the development over as long a period as that here given, namely, two months to nine weeks. We have no precise observations concerning the length of life of any individual in any one stage; neither do we know the number of eggs laid by each female, except as an inference from dissections. I have counted as many as fifty well-formed eggs of nearly full size in the ovaries of a single female beetle.

HABITS OF BEETLE AND LARVA.

The growing larvæ remain concealed from view within the roots, burrowing, not through the middle but nearer the surface, in a slightly sinuous longitudinal direction, sometimes from the stalk outwards, but more frequently mining inwards from the outer end of the root. They have considerable power of locomotion when removed from their burrows and seem capable of going from one root to another. Indeed, the fact that they must concentrate in hills of corn after hatching demonstrates their power of locomotion when still very young. It is altogether likely, consequently, that if a hill of corn is killed by them before they have reached maturity they will be entirely able to search out another.

When full grown they leave the root preliminary to pupation, shortening up and changing to the pupa stage in the dirt close by. At this time they may often be found in considerable numbers by pulling up infested corn and shaking out the dirt from the roots. The beetles emerge from the pupa under ground, and, coming to the surface, most commonly crawl up the stalk of corn adjacent. When recently transformed they are of a pale yellowish color with scarcely a tinge of green. Their first food consists, as already mentioned, of the softer tissues of the corn plant itself, especially of the silk at the tip of the ear or the pollen from the tassel, or sometimes of the soft kernels, especially if these have been exposed by any injury to the husks. They also spread to various blossoming weeds in the field and after a time begin to desert the corn field, scattering elsewhere for food. It is commonly towards the last of August that they are first noticeably frequent on thistle blossoms, heads of clover, and other outside blooming plants. They do not, however, leave the corn fields generally for some time thereafter, but may be found there in greatly diminished numbers at least as late as the middle of October.

How soon after pairing their eggs are laid we do not now know; neither has the process of oviposition ever been directly witnessed. The frequent occurrence of dead female beetles (in October and November) in the earth in corn fields in the midst of the eggs, and the distribution of the eggs themselves, are, however, sufficient evidence that the beetle enters the earth to lay her eggs, and that she may perish there after her ovaries are spent. Although the eggs of this beetle have never been found outside of corn fields, notwithstanding extensive search in many other situations, it is certain that the eggs are not necessarily all laid before the female leaves the field in which she emerged. I have, on the contrary, frequently proven by dissection of beetles taken from flowers by roadsides, in meadows, and the like, that females thus dispersed may still contain eggs in large numbers. A considerable part of the beetles, and apparently the greater part, do, however, lay their eggs under ordinary circumstances before they leave the field of corn; and it is also highly probable on general grounds that those which go elsewhere in search of food return to corn fields for oviposition. Since the larva is not known to infest any other plant than corn, or, indeed, to be capable of living upon any other, it is altogether likely that the female instinctively searches out the corn plant when seeking a place of deposit for her eggs.

As this is a surmise or inference, however, and not a matter of observation, it remains possible that if the corn root-worm is neglected it may in time accumulate in such numbers as no longer to confine its chief injuries to fields previously in corn, but that the beetles, forced to scatter early, in search of food, from the fields in which they emerge will deposit their eggs freely everywhere in the ground, instead of being confined as now chiefly to corn fields. It is probably in fields of clover that this is most likely to occur, since the beetles sometimes become abundant there, feeding upon the pollen of the second growth.

The depth at which the eggs are laid varies from an inch to five or six inches, the greater part of them being near the surface of the ground. They are usually deposited in bunches of three or four to eight or ten within a space of half an inch across, not in contact with each other nor in any cell or cavity, but always simply scattered in the earth. Most careful examinations made in 1882, and many times repeated, of the earth between the rows, and of the roots of all the weeds growing in the field, have failed to discover so much as a single egg outside a space a few inches across, around each hill. A similar careful search of the roots of thistles, ragweeds, and goldenrod outside the fields, upon the flowers of which the beetles were feeding in great numbers, had a similar result; and we have found no evidence in the roots of these plants, either in the corn fields or elsewhere, that they have ever been infested by the larvæ. In short, not the slightest direct proof has thus far been found that the beetle breeds anywhere except in fields of corn. It is very probable that a few develop in other situations; but the number seems to be so small as to defy discovery, except by accident.

PREVENTION AND REMEDY.

A judicious rotation of crops is so simple and complete a preventive measure that *remedies* for injury to corn by the northern corn root worm are practically unnecessary. The eggs being laid in corn ground in the fall and the larvæ hatching the following spring, feeding so far as known upon nothing else but corn, the planting of such infested land to any other grain must inevitably lead to the starvation of the young when they hatch in spring. This is not an inference from the life history of the insect merely, but even before the time and place of oviposition were known, it had been commonly noticed that corn was rarely if ever liable to injury by this insect if planted on ground which had borne any other kind of crop the preceding year.

The frequency of the rotation must depend upon circumstances, and especially upon the general abundance of the insect at the time. I know of no part of Illinois in which corn is not safe for at least two years, and in many situations another year may be added to this period. No field on which this crop has already suffered to any noticeable extent should be planted to corn the following year; and it will likewise be prudent to avoid continuing in corn any field in which the grass-green beetle of this species is seen to be abundant in September and October.

The only other preventive measure worthy of mention is one equally to be commended as a general agricultural practice; namely, the maintenance of the fertility of the soil by the use of manures, etc. This will not, so far as known, diminish in any way the amount of insect attack, but it will enable the plant to stand a minor injury with relatively little loss. It is possible that experiments with various kinds of fertilizers will show that some of them, the potash salts for instance, may have an immediate deleterious effect upon the larvæ in the earth, but we have at present only a speculative basis for this supposition.

THE CORN CUTWORMS.

Hadena devastatrix Brace.
H. arctica Boisd.
Agrotis ypsilon Rott.
Peridroma margaritosa saucia Hubn.
Noctua c-nigrum Linn.
Feltia subgothica Haw.
F. jaculifera Guen.
F. gladiaria Morr.
Nephelodes minians Guen.
Hadena lignicolor Guen.
Noctua clandestina Harr.
Feltia annexa Tr.
Euxoa messoria Harr.
E. tessellata Harr.
E. ochrogaster Guen.
Mamestra renigera Steph.

The caterpillars commonly known as "cutworms" destroy the young corn plant by eating the leaves, gnawing into the stalks, and cutting off the plant close to the ground at night, often dragging the severed part into their holes near by. They hide by day under clods, or by burying themselves a little distance in the earth, where they may be easily found curled up into a close spiral or a circular disk. They are thick, soft-bodied, rather sluggish caterpillars, with nearly smooth skins, varying in color from whitish to dark brown, variously marked, in many cases with longitudinal stripes, and often with dark dashes and blotches additional. They are most destructive in corn following on grass or clover, but sometimes come into the field from meadow or pasture lands adjoining, when the outer rows of corn, of course, suffer worst. Where they are very numerous it is virtually impossible to obtain a stand of corn until the period of their active injuries is passed. Many of them, when they become so numerous on any spot as to overtax their food supply, move out of the overpopulated field in companies not unlike those of the notorious army-worm. The latter belongs, indeed, to the cutworm family, and when only ordinarily common lives and feeds, generally speaking, like the cutworms of this list.

Most of the species pass the winter partly grown, and are consequently prepared to make their attack on corn as soon as it shows above ground. They enter the earth for their transformations when full grown, at times varying for the different species, most of them in late June or early July. They change in the earth to leathery, brown pupæ, from which grayish or brownish night-flying moths—the adults of the species—emerge later in the season, and, laying their eggs in grass-lands, perish before the winter. The young hatching from these eggs live on the roots of grasses until cold weather, doing no noticeable injury, as a rule, during this fall period.

The greater part of them develop, in our latitude, only a single generation each year, but a few of the most destructive species are two- or three-brooded. This fact seems to make little difference, however, from the economic point of view, except as the single-brooded species are less able than the others to take prompt advantage by their rate of increase, of specially favorable conditions of location, crop, or weather of the season.

Injury to corn by cutworms is best prevented by midsummer or early fall plowing of grass-lands to be planted to corn; by pasturing pigs on grass or clover lands to be plowed up for corn; by distributing, by the aid of a seed-drill, a line of dry bran or middlings poisoned by mixing in Paris green at the rate of a pound of the poison to thirty pounds of the foodstuff, or by scattering poisoned food in spring along the borders of corn fields next to grass; and by replanting when corn is killed by them, postponing this step, however, until the cutworm injury has practically ceased for the season. The earlier the preceding year grass-lands to be planted to corn are plowed, the less will be the probability that the cutworm moths will have laid their eggs thereon, and the less, consequently, will be the danger of injury by cutworms the following year.

The points in the life history of the various cutworms essential to successful management are thus the time when the greater part of the eggs are laid for the hibernating brood of the caterpillars, and the time when this hibernating brood gets its growth in spring, ceases its injuries, and goes into the ground for its change to the pupa state. The first date shows when the ground should be plowed for corn in fall; and the second, when it may safely be planted or replanted to corn in spring.

Cutworms entering the corn field from pastures or meadows adjoining may be effectively and cheaply poisoned by placing along the edges of the field fresh clover or other succulent vegetation which has been cut after spraying thoroughly with Paris green stirred up in water at the rate of a pound to fifty gallons.

The sixteen species whose names are placed at the head of this section have all been found injuring corn—only the first nine of them, however, notably harmful to that crop in Illinois.

THE GLASSY CUTWORM.

Hadena devastatrix Brace.

This is a translucent, whitish caterpillar (Fig. 38), slightly tinted with bluish green, without body spots or blotches, the head red or red-brown and the neck-shield brownish. Its appearance has been quite aptly characterized as midway between that of a white grub and a common cutworm. It is quite similar to the yellow-headed cutworm next described, from which it is most readily distinguished by its darker head and neck-shield and the lighter color of its body.

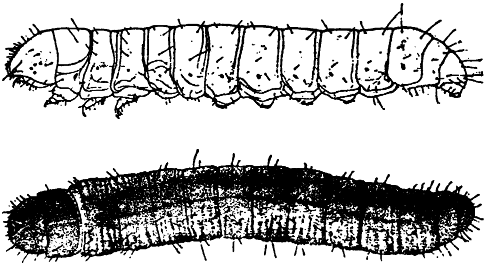

FIG. 38.—Glassy Cutworm (*Hadena devastatrix*), back and side views. Enlarged.

In view of the destructive nature of its attacks, its wide-spread range and great abundance, and the numerous published reports of serious injury to crops, this cutworm may be properly regarded as the most serious pest of its kind to corn and grass. It is rarely seen above ground, but works mainly in a burrow beneath the surface, feeding principally at night, eating off the roots close to the base of the stem, or cutting off the latter under ground.

We have found it very destructive to corn in Peoria and Henry counties, and frequently occurring in corn hills in various parts of the state. A. J. Cook reports it as injurious to corn in Michigan; Lintner, in New York; and Harvey, in Maine. Gillette pronounces it the most abundant and destructive cutworm in corn and grass in Iowa; Smith reports it as one of the most destructive of its kind in New Jersey; and Fletcher finds it injurious in

Manitoba. It frequently becomes so numerous in meadows as to be notably injurious to grass. In Ohio, for example, twenty acres out of thirty of a timothy meadow were so injured by this cutworm that the grass became dry enough to burn.

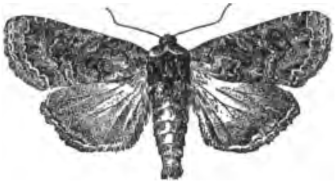

FIG. 39.—Adult of Glassy Cutworm (*Hadena devastatrix*). Natural size.

In mixed fields of timothy and clover they have completely destroyed the timothy, leaving the clover unharmed. In Indiana a large area in each of three timothy fields, amounting to fifty acres in all, was totally destroyed. There was an evident migration of the cutworms in this case out of the low lands in which they originated. They have destroyed lawns in Fargo, North Dakota, and in Glencoe, near Chicago. In Canada it was found necessary to plow up several fields of winter wheat which were destroyed by them in spring, and fields of oats were seriously injured and replanted. A piece of sod land in Ohio badly infested by these cutworms was broken up in winter and planted to seedling peaches, but in the following spring thirty-five per cent. of these young trees were cut off two or three inches above the roots. Lugger says that they are very destructive to strawberry plants in Minnesota, cutting away the crown and causing the plant to wilt away. They have also injured strawberry plants in the Southern States and garden vegetables in Mississippi.

Besides these farm crops they may feed upon almost any kind of herbaceous plants, including cabbages, beans, radishes, hollyhocks, and lettuce. They evidently develop mainly in grass-lands, especially in low ground, and do their most serious injuries to crops following upon grass.

The species is found in the United States from the Atlantic to the Pacific, and also in Canada and in Europe. It is least abundant in the extreme south.

It appears to be single-brooded. The eggs are laid in the latter part of the season, mostly, according to Gillette, after August 1, and hatch before cold weather, the larvæ making their destructive attack in the latitude of central Illinois in the following May and the first half of June. They change to the pupa in the ground in June or the early part of July, occasionally as late as August. The moths (Fig. 39) begin to appear in June, become very abundant in August, and may remain until October. Garman found, November 25, a single cutworm of this species, which reached the moth stage the following April.

From this it follows that grass-lands must be plowed in August if they are to remain free from the eggs of this cutworm moth, and that corn planted late in June will probably remain uninjured by the cutworm itself.

THE YELLOW-HEADED CUTWORM.

Hadena arctica Boisd.

It is very similar in appearance to the glassy cutworm just described, but may be distinguished by the fact that its body is pale smoky gray, while the head and neck-shield are both tawny yellow. It is without stripes, spots, or other body colors. It is so similar to the preceding species that it has often been confused with it, and it is consequently impossible to separate published statements concerning injuries due to the two. It lives usually about two inches under ground, cutting off the roots of grasses, grains, and corn, and the stems below the surface.

It is frequent, but not very common, in Illinois, and is widely distributed northward in Canada, Labrador, Vancouver, and in subarctic America and Europe generally. It occurs as far south as New Mexico, and is generally wide-spread east of the Rocky Mountains. In 1895 the moths were so abundant in western Ontario as to be a general nuisance, filling lamps and windows and soiling curtains and clothes. In the following season these cutworms did great damage to fields of oats, wheat, and corn, many of the fields being plowed up and replanted. Cook has found it injurious to corn in Michigan. In New York, Fitch observed that these cutworms would finish first any living grass remaining in the corn field, but would then attack the crop itself.

Besides grasses and cereal crops, they feed on various herbaceous plants, such as cabbage, spinach, and lettuce, and on succulent shoots, like those of roses and currants.

This cutworm lives longer in the stage of destructive activity than many of the other species, often continuing its injuries beyond the middle of June, and even into July. It pupates in June or July, and the moths begin to appear late in June, becoming commonest in July and early August and lasting until September. Eggs have been deposited as early as June 13.

THE GREASY CUTWORM.

Agrotis ypsilon Rott.

This is a common, wide-spread, and destructive cutworm, injurious to garden vegetables and to fruits as well as to corn. When full grown (Fig. 40) it is about an inch and a half in length, of an almost uniform dark, greasy gray, with a faint dorsal stripe of dull, dirty yellow. Beneath it is an obscure greenish yellow.

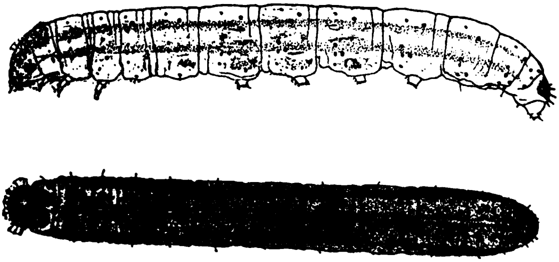

FIG. 40.—Greasy Cutworm (*Agrotis ypsilon*), side and back views. Enlarged.

This is a typical cutworm in its feeding habits, and is one of the commonest of its kind in corn. It feeds also on grass, asparagus, cotton, tobacco, tomato, cabbage, potato, spinach, squash, beans, beets, apple, grape and strawberries, but has not been reported as injurious to clover or as breeding in fields of that crop.

It is found throughout the United States, and, indeed, throughout the world, ranging to the northward as far as Manitoba and Hudson Bay, to the south as far as Uruguay and New Zealand, and the Cape of Good Hope in Africa. It occurs in India, Ceylon, and China, and is a common European species also.

While destructively abundant at times and in especially favorable situations, it is not, so far as we know, subject to periods of very extraordinary increase. It is much parasitized, when abundant, by dipterous and hymenopterous parasites, and these must serve as a severe and ready check upon its multiplication.

This cutworm is apparently, but not certainly, single-brooded. It passes the winter mainly as a caterpillar, in various stages of growth; begins to feed, of course, as soon as spring revives it, and continues more or less injurious well through June, and sometimes even into July. The destructive activity of this cutworm usually reaches its height in the latter half of May and in early June, and then declines gradually through the first half of July. A few of the larvæ cease feeding, however, in May, and complete their changes to the adult stage (Fig. 41) during that month, but the transformations of the greater part of the hibernating generation occur in June. Egg-laying begins, according to our observations, in July, the new generation sometimes beginning to hatch in the grass within a fortnight of the disappearance of the last of the cutworms of the preceding year. This species may consequently be found in the cutworm stage at practically all times and seasons. Pupæ found in our breeding-cages on the 8th of June gave the moths in four weeks, and eggs laid July 3 hatched in twenty-two days.

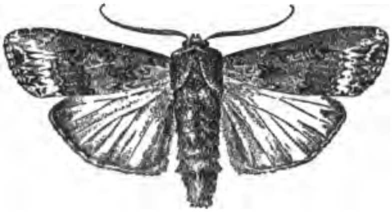

FIG. 41.—Adult of Greasy Cutworm (*Agrotis ypsilon*). Natural size.

Beginning early in July, the laying of eggs doubtless continues through August, and possibly into September also. The moths have been most frequently found by us in July and August, with only occasional occurrences in September, the latest on our notes for central Illinois being September 20.

Breeding almost wholly in grass-lands, its injuries to corn are to be apprehended only where this crop follows upon grass, or where the corn field adjoins a pasture or meadow. In the former case the injury may be generally distributed throughout the field, but in the latter it will be limited chiefly to the side next to grass. It continues its injuries so late in spring that it is difficult for the corn grower to escape it by late planting, and even the first replanting of injured fields may fall a sacrifice to it; but plantings made as late as the first or second week in June will be practically safe from serious injury by it. On the other hand, the early date at which the moth begins to lay her eggs lessens the value of fall plowing as a preventive measure. Probably pasturing of infested fields of grass by pigs in fall, before breaking up for corn, is the best general preventive measure available in ordinary practice.

THE VARIEGATED CUTWORM.

Peridroma margaritosa saucia Hubn.

(*Agrotis saucia.*)

This cutworm, when fully grown, is about an inch and three quarters long, and is easily recognized by its conspicuous markings. (Fig. 42, *b*, *c*, *d;* Fig. 43.) The general effect of its ground-color is grayish or brownish—usually variable, however, being light or dark as its surroundings expose it more or less to the light, those on trees or bushes being darker than those feeding near the ground on broad-leaved herbs. It is most easily distinguished, when of average color, by a row of four to six pale dots extending from the neck half way or more down the back, and a velvety spot on the segment next to the last, sharply defined behind, but shading gradually forward into the dark ground-color of the back. The freshly hatched caterpillars are greenish, with black heads.

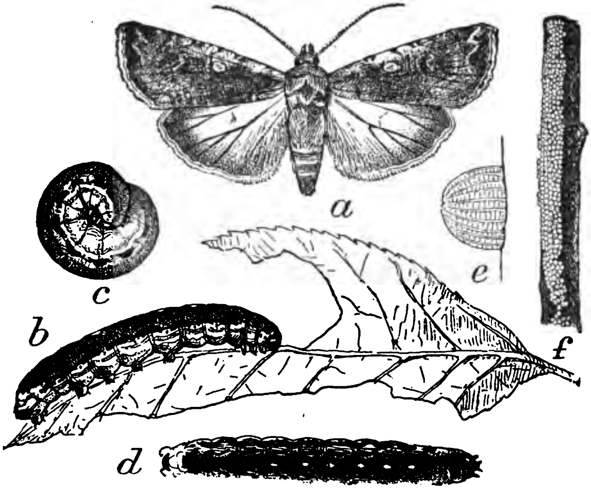

FIG. 42.—Variegated Cutworm (*Peridroma margaritosa saucia*): *a*. adult; *b,c,d,* larvæ; *e, f,* eggs. Figure *e* greatly enlarged; others natural size. (Howard, U. S. Dept. of Agriculture.)

This is a very common species, but is peculiar in its habits. It climbs plants freely at night to feed, even ascending bushes and fruit trees, and devouring any succulent tissue which it finds, including bud, fruit, flower, leaf, stalk, or root of the plant. It occurs frequently in corn fields, although not ordinarily common there. When very abundant it sometimes migrates in hordes like the army-worm, in search of food, and under such circumstances has been known to destroy hundreds of acres of young corn in a comparatively short time. It is pre-eminently a garden pest, however, being particularly destructive to fruits, vegetables, and flowers rather than to grain crops, weeds, and wild plants. A remarkable outbreak of this cutworm occurred in the year 1900 in the United States and Canada, especially in the states of the Pacific coast. Enormous damage was done by it, particularly to fruit and vegetable crops. A full account of this occurrence will be found in Bulletin 29, N. S., U. S. Division of Entomology, and in Bulletin 47 of the Experiment Station of Washington state. Among its leading food plants are cabbage, tomatoes, potatoes, clover, onions, peas, beets, and carnations.

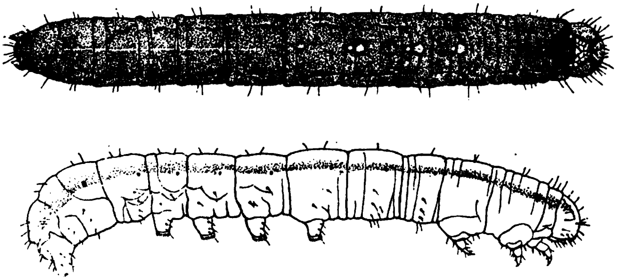

FIG. 43.—Variegated Cutworm (*Peridroma margaritosa saucia*), back and side views. Enlarged.

It occurs throughout nearly the whole of the New World, and also in western and southern Europe, northern Africa, and Asia Minor.

The seasonal history of this species is not yet well understood. It has been seen in winter as larva, as pupa, and as adult, and entomologists differ, consequently, in their statements as to its normal hibernating stage and the number of its broods. It agrees with most of the species, however, in the fact that it is destructively active in early spring, becoming most injurious in May and early June, pupating in June, and beginning to produce moths (Fig. 42, *a*) abundantly in the latter part of that month. The data which we have, suggests at least two broods in a year, but there is nothing conclusive upon that point. Eggs (Fig. 42, *e*, *f*) of this species were sent to us March 27 on an apple twig from Vandalia, and others were sent us April 17 from Hardin county, in southern Illinois, which were just hatching when received. The young cutworms were kept on clover until May 26, by which time they had reached an average length of about one inch, being, in other words, at this date somewhat more than half grown. Female moths, on the other hand, confined in a breeding-cage with blue-grass July 10, had given origin six days later to freshly hatched larvæ, with which the cage was swarming at the time. Unfortunately, these presently died—probably because the food plant offered them was unsuitable. Other entomologists have several times secured and hatched the eggs of this species in the latter half of the season. In 1900 cutworms of this species—probably of the second brood—began to appear early in July, reached their greatest abundance about July 25, and had disappeared by the end of the following month. The advent of winter commonly finds individuals in every stage of growth, and moths, larvæ, and doubtless pupæ also may pass the winter successfully. We once found four larvæ in early December under boards and weeds in grass and corn. Two of these were about a third of an inch in length, and the others were approximately an inch and a quarter. Two full grown larvæ were also found January 14 and 24.

Fortunately, this cutworm is not ordinarily sufficiently injurious in corn fields to require special precautions except when it moves in companies from its breeding grounds, and then it may be dealt with, like the army-worm, by measures to be described in the article on that species.

THE SPOTTED CUTWORM.

Noctua c-nigrum Linn.

The spotted cutworm is a common species, injurious in Europe as well as in America, especially to garden vegetables, which it seems to prefer to grasses and grains. It has occasionally injured Indian corn in various states, and like the species just discussed, is liable to travel in companies when it becomes very numerous. Under these circumstances it might require the especial attention of the corn grower. It is on record also as injuring wheat in January and in March (Webster).

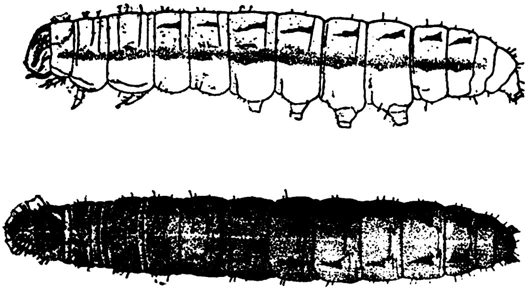

FIG. 44.—Spotted Cutworm (*Noctua c-nigrum*), side and back views. Enlarged.

It may be recognized (Fig. 44) by two rows of triangular black spots, one on each side of the back, with the narrow angle to the front, largest and darkest on the posterior segments of the body, and fading out before they reach the head. The general color of the caterpillar is pale brownish or ashy gray, and it is about an inch and a half long when of full size.

It hibernates as a cutworm nearly full grown, and pupates quite early, in central Illinois late in April and early in May; consequently, if injuries to corn are due to this species they will soon cease, and the first replanting will commonly escape unharmed. Moths (Fig. 45) from pupæ formed in April and early May have appeared in our breeding experiments during the latter part of May and the first half of June, and, proceeding without much delay to deposit their eggs, they gave origin to a second brood of cutworms which became fairly well grown about the middle of July. This generation is not often found in the corn field, and does no injury there worth noticing. The moths from this second brood have appeared in our breeding-cages from late July to the middle of August. They continue alive in the fields throughout September, and lay their eggs in grass for the hibernating brood of the cutworms.

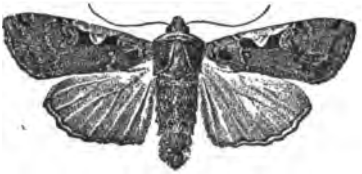

FIG. 45.—Adult of Spotted Cutworm (*Noctua c-nigrum*). Natural size.

Early fall plowing of infested grass-lands may thus be expected to take effect on this cutworm by preventing the laying of many of the eggs, and by causing the starvation of many of the young which may already have hatched.

THE DINGY CUTWORM.

Feltia subgothica Haw.

THE WESTERN STRIPED CUTWORM.

Feltia jaculifera Guen.
(*Agrotis tricosa*, *A. herilis*.)

The dingy and the striped cutworms are remarkably alike in both appearance and habits, and may well be treated together. The former (Fig. 46) is dingy gray, and easily recognized by the dusky band on each side of the back, obliquely notched on the inner border like the edge of a serrated leaf. The broad dorsal space between these bands is a buffy gray. There are also a well-marked light band along each side side of the body, and dorsal and lateral pale lines rather feebly marked.

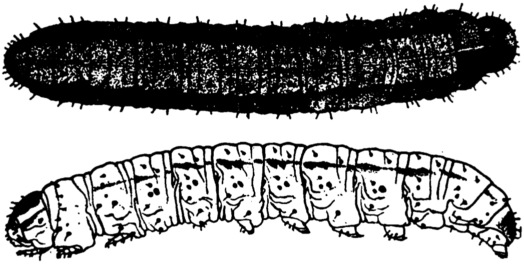

FIG. 46.—Dingy Cutworm (*Feltia subgothica*), back and side views. Enlarged.

The western striped cutworm is very closely similar to the preceding, perhaps indistinguishable in the caterpillar stage. Riley says, indeed, that it is more dingy than *subgothica*, with less conspicuous lines, and with a more decided buff tint to the dorsal band. These differences are, however, within the range of ordinary variation, and the species can apparently be distinguished with certainty only by breeding to the adult. The young larvæ are much darker at first, sometimes nearly black.

The dingy cutworm is one of the commonest species, especially in corn, where it shares with the greasy cutworm the principal injury to that crop. Indeed, there is some reason to believe that the moth may lay her eggs in fall among the succulent weeds in the corn field, particularly when a severe drouth has made the pasture and meadow lands less inviting. In accordance with this supposition these cutworms have not infrequently been found in early spring generally distributed through corn on old corn ground. Stedman speaks of it in Missouri as the most destructive cutworm in wheat. In our breeding-cages it has evidently preferred clover to blue-grass. It is especially fond of early vegetables, including melons, cabbage, tomatoes, beans, peas, sweet potatoes, turnips, lettuce, celery, and strawberry plants. It occasionally climbs fruit trees and shrubs to devour their buds and leaves.

The striped cutworm is also decidedly destructive to corn, according to Webster, one field in Indiana being completely ruined by it in 1895. Similar injuries were noticed in the same year in Missouri, Kentucky, Tennessee, and southern Ohio. It was the most abundant cutworm in southern Illinois in the outbreak of 1887, and next to *gladiaria* the commonest and most destructive throughout the State during that of 1888. It did much harm to corn in these years, but was especially injurious to clover, for which it had an evident preference, and to the meadow grasses. It frequently migrates when abundant in search of food, but without the concerted movement of the true army-worm.

Both of these species are generally distributed throughout the United States and Canada east of the Rocky Mountains. The dingy cutworm is also found on the Pacific coast, and we have specimens of the moth from Montana, Wyoming, and Utah. The striped species occurs in British Columbia.

There is but one brood of the dingy cutworm each year. Moths have been taken throughout July, August, and September, but much the most abundantly in the latter part of August. Eggs are quickly deposited, and hatch in about a week. The caterpillars grow slowly, and hibernate when quite small. Those taken by us in January, February, and March average less than half an inch in length, but when warm weather comes they grow apace, and in May become nearly full grown. In June they cease feeding, mostly in the first half of the month, and enter the ground for pupation. A dingy cutworm kept under observation in my insectary from May 15, entered the ground June 16, and continued as a larva in its earthen cell until August. On the 12th of this month it was found to have changed to the pupa, and upon the 28th it became an adult. This long-delayed pupation was not due to drouth, as the earth in the breeding-cage was kept moist, and even wet. Besides the above we have found larvæ of different lots in a similar condition in our breeding-cages June 15, July 2, 19, and 23, and Aug. 3. These facts indicate an unusually long period of midsummer preparation for the pupal transformation.

This life history suggests nothing exceptional by way of prevention or remedy. Where the field has become infested in fall, as shown by the general distribution of the cutworms in the corn in early spring, replanting, to be safe, should be postponed until towards the middle of June.

THE CLAY-BACKED CUTWORM.

Feltia gladiaria Morr.

This cutworm (Fig. 47) is usually dark in average color, varying, however, from greenish gray to dark brown. The back is commonly decidedly light, grayish white or straw-color, or occasionally reddish brown. This light dorsal space is divided lengthwise by a more or less conspicuous median white line, which is usually bordered with darker. On each side of the pale dorsal space are two irregular whitish lines. The full grown larva is about an inch and a quarter in length.

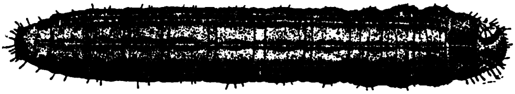

FIG. 47.—Clay-backed Cutworm (*Feltia gladiaria*). Enlarged.

This species is extremely variable in numbers, multiplying under some conditions to become a notable and widely destructive pest, and then occurring in scarcely noticeable numbers for some years thereafter. It was not distinguished as a cutworm until 1888, when it was bred to the adult in our insectary. In 1887 and 1888 it was the most destructive cutworm in Illinois, especially to clover and young corn. In 1895 it was by far the leading species in a general cutworm outbreak in Kentucky, and caused serious injury to a thirty-acre field of young corn on old sod ground near Champaign. In 1901 it was one of the most abundant cutworms in corn fields in western Illinois, and was excessively abundant in pansy beds at Urbana, cutting off and destroying all the plants. During its years of greatest abundance here it was especially notorious for its injuries to clover, which it preferred to blue-grass. It likewise ate oats, grass, and corn, invading corn fields from adjacent meadows, and devouring the plants as it went as thoroughly as does the army-worm. It feeds likewise on potatoes, beans, sweet potatoes, cabbage, tomatoes, and onions. When very abundant and their food supply had run short, these cutworms scattered in all directions—a habit common in varying degrees to most of the cutworms. Its mode of feeding is different from that of the cutworms generally, the corn leaf being seized by the hanging tip, drawn down, and eaten to the base. In clover fields it begins at the tip of the plant and works downward, collecting about the roots.

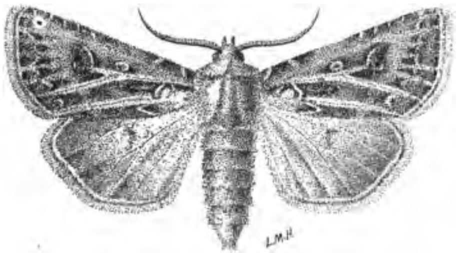

FIG. 48.—Adult of Clay-backed Cutworm (*Feltia gladiaria*). Enlarged.

This species is registered as inhabiting the United States east of the Rocky Mountains, but we have specimens of the adult from Utah and Colorado also.

It spends the winter, in our latitude, in the caterpillar stage, and is active in the destruction of its food plants from the middle of April to the beginning of June. By the middle of June all the cutworms have entered the earth for transformation. They do not change forthwith to the pupa stage, but remain there for a considerable period—more than six weeks in some cases—in a dormant or torpid condition. Moths (Fig. 48) consequently do not appear until September and early October, being most numerous in the latter half of September. Eggs are then laid without delay, and from these the larvæ hatch, which pass the winter partly grown.

It follows from this life history that the main measure for the protection of corn against this cutworm must be an impassable furrow along the margin of the field next to grass or clover, or, in the absence of this, the distribution of poisoned food—clover particularly—where the cutworms are likely to be drawn to it. Owing to the lateness of the period when the eggs are laid, a reasonably early fall plowing will prevent the breeding of the species on that ground.

THE BRONZE CUTWORM.

Nephelodes minians Guen.

This is an unusually large and plump cutworm (Fig. 49) about an inch and three quarters in length, conspicuously marked with alternate stripes of olive-bronze and yellowish, the former much the broader. A pale stripe runs along the middle of the back, and there are two such on each side, the lower below the spiracles. The bronze space immediately above the last is frequently divided lengthwise by a delicate, broken, yellow line. The head is yellowish or gray, the neck-shield darker, with five pale stripes.

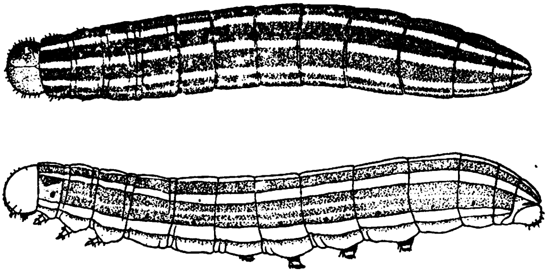

FIG. 49.—Bronze Cutworm (*Nephelodes minians*), back and side views. Enlarged.

This is essentially a grass cutworm, being one of the commonest of its kind in grass-lands in early spring. It is somewhat injurious to corn, especially if this is planted on pasture or meadow lands occupied by it the preceding year. It eats clover sparingly or not at all, but seems to have a special preference for timothy. In the corn field it devours the whole plant instead of merely gnawing through the stem. It is not a garden species, although it sometimes climbs fruit-trees when its normal food is scarce, feeding on the buds and leaves like other so-called climbing cutworms.

It is generally common and abundant throughout the United States and Canada. In Iowa it is regarded by Gillette as the most abundant species, next to the glassy cutworm, in fields of grass and corn. It did much injury to grass in New York in 1881, and worked unprecedented destruction in 1886 near Columbus, Ohio, where, late in May, scarcely an acre of meadow or pasture had a vestige of grass on it for a distance of several miles, many fields being dry enough to burn. About three thousand acres were thus destroyed, the larvæ migrating *en masse* when their food was exhausted.

Hibernating in our latitude in the larval stage, they are found active in grass-lands in April and throughout May. They begin to disappear about the 1st of June, and all are gone by about the middle of that month. They remain under ground for a considerable period without pupating, changing in late July and August. The moths (Fig. 50) first appear in early August, become most abundant during the first half of September, and continue into October. The hibernating caterpillars have the singular habit of sometimes coming forth in winter and crawling about on the snow and ice. In the South, adults are frequently taken during the winter months.

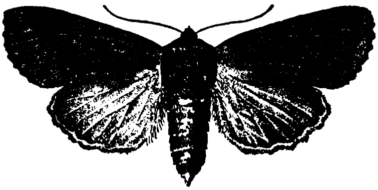

FIG. 50.—Adult of Bronze Cutworm (*Nephelodes minians*). Natural size.

This cutworm is present in very unequal numbers year after year, what seems to be a bacterial disease checking its increase when it becomes unusually abundant. On this account, and also because much subject to insect parasitism, it is not likely to be excessively abundant in the same locality for two successive years.

The facts concerning it suggest no special preventive or remedial measures other than those frequently referred to in this article. Where it is so abundant in grass-lands as to threaten a migratory movement, this may be arrested by measures usually applied against the army-worm. In case it scatters into corn from adjacent fields of grass, it may doubtless be killed by the use of poisoned food, particularly the mixture of middlings and Paris green. In case corn is so injured by it as to require replanting, this may be safely done any time after the first of June, or possibly as early as the last week in May. To be sure that a grass sod shall be virtually free from the eggs, this should be plowed as early as the first week in September.

THE W-MARKED CUTWORM.

Noctua clandestina Harr.

This caterpillar (Fig. 51) is marked with four longitudinal rows of dark spots and some dark and pale longitudinal lines. The spots of the outer row on each side are oblique and sometimes unite to form a continuous line; those on the inner row are more or less triangular (most evidently so on the kinder segments) and occasionally have the shape of the letter W.

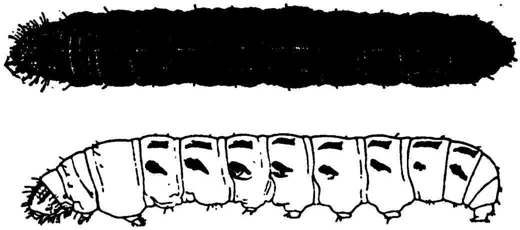

FIG. 51.—W-marked Cutworm (*Noctua clandestina*), back and side views. Enlarged.

This is a very wide-spread species and a general feeder, but is ordinarily much more abundant in the east than in the north-central states. It is not found in the South. Dr. Lintner regards it as the most injurious corn cutworm in New York, where it is said to be common also on grass and grain and to feed on buckwheat and clover. It is fond of garden vegetables and feeds on lettuce, cabbage, celery, pumpkins, and beans. It is a well-known climbing cutworm, ascending trees and shrubs to eat the buds and leaves, particularly those of the apple, box-elder, soft maple, currant, and gooseberry. Plantain is mentioned as one of its wild food-plants.

The larvæ winter over about half grown and mature early, becoming most injurious in April and May. The moths begin to appear soon thereafter and are most abundant about June 20. The data on record indicate a probable second brood of the cutworms in midsummer, the moths appearing in August, September and October.

The early transformation of the hibernating brood renders precautions against this cutworm virtually unnecessary, since it can injure only very early plantings of corn.

THE GRANULATED CUTWORM.

Feltia annexa Tr.

This species is best known by its rough, granulated skin and by a pair of oblique marks on each segment, diverging backward. (Fig. 52, *a*, *e*.)

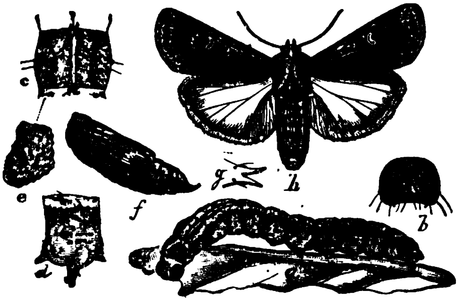

FIG. 52.—Granulated Cutworm (*Feltia annexa*) *a*, larva; *b*, its head, front view; *c*, *d*, one segment, top and side view; *e*, surface; *f*, pupa; *g*, tip of pupa; *h*, adult. Figures *a*,*f*,*h*, natural size, others enlarged. (Howard, U. S. Dept. of Agriculture.)

It is a general feeder, devouring corn, wheat and other cereals, cotton, clover, grass, cabbage, peas, beans, and several weeds. It is particularly well known in the Southern States as a cotton cutworm, sometimes so badly injuring this crop as to compel replanting.

It is not common in Illinois, but is found, nevertheless, across the country from Massachusetts to California, and is abundant from Kentucky southward and also in Cuba and South America. Lugger records a single capture in Minnesota.

The facts with regard to its seasonal history have not yet been clearly established. It seems to winter as a larva and is most destructive in April and May. Moths (Fig. 52, *h*) of this brood appear in June, July, and August. From eggs laid Aug. 3, moths were reared again by October. Beutenmuller says a second brood flies in August, September, and October. There are almost certainly two generations in a year in Illinois, and quite likely three, or more, in the Gulf States.

THE DARK-SIDED CUTWORM.

Euxoa messoria Harr.

The common name of this cutworm (Fig. 53, *a*) is due to the contrast of a dark stripe on each side with the ashy gray ground-color. The small shining spots surrounding the hairs are conspicuous and black.

Although one of the great destructive cutworms of the United States, this species is not reported as particularly injurious to corn. It is one of the climbing cutworms, and its most notorious injuries are done to fruits and garden vegetables. It is charged with a great destruction of the peach crop in Illinois, Indiana, and Michigan in 1887, and with devouring about half the onion crop of Orange, N. J., in 1885 and 1887, and again in 1896. In California it was held responsible in large part for the defoliation of grape-vines in Fresno county. Smith speaks of it as the most injurious cutworm in southern New Jersey, especially to sweet potatoes. It ascends fruit trees, the apple especially, and eats the buds of both flowers and leaves. It feeds, besides, on cabbage, spinach, lettuce, potatoes, tomatoes, beans, peas, radishes, turnips, tobacco, and sugar-beets. Specimens in confinement have freely eaten grass, corn, clover, buckwheat, currant, soft maple leaves, and various fleshy weeds. Indeed, it is so general a feeder, Gillette remarks, that in confinement it has not refused to eat any green thing offered it.

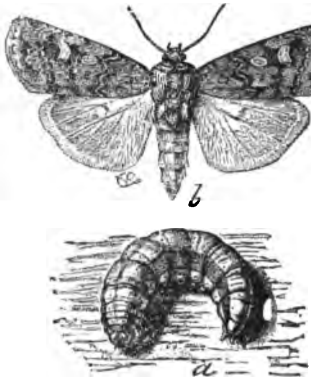

FIG. 53.—Dark-sidea Cutworm (*Euxoa messoria*), larva and adult. Natural size.

This species is not particularly common in Illinois, and has been rather infrequent in our collections either as caterpillar or as moth. It has been reported injurious, however, from New York to California and Washington state, and northward into Canada. It seems to be comparatively rare to the southward.

It is evidently a single-brooded species, the caterpillars being most abundant in May and disappearing by the middle of June. Occasionally adults (Fig. 53, *b*) occur in the latter part of June, but the main body of them appear late in July, and are most abundant in September up to about the 20th. The stage of hibernation is not yet positively ascertained. Caterpillars, apparently of this species, were taken by me from the stomachs of robins shot in February and March, and the species probably hibernates in the larval stage.

Highly satisfactory experiments for the destruction of this species and the protection of garden crops have been made by Sirrine, in New York, who used a mixture of twenty or thirty pounds of middlings or bran—the former preferred—to one of Paris green. A continuous row of this poisoned bait was laid along the ground by means of a seed-drill.

THE COMMON STRIPED CUTWORM.

Euxoa tessellata Harr.

About one and a fourth inches in length, gray in general color, with a pale central dorsal line and three pale lines each side, the lower one the broadest.

The recorded food plants of this cutworm are corn, potato, onion, tobacco, radish, squash, cabbage, lettuce, tomato, celery, spinach, beans, flax, cucumber, melon, beet, and parsnip, together with smartweed, *Rumex*, and

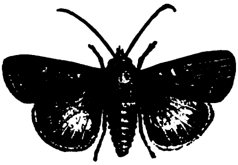

FIG. 54.—Adult of Common Striped Cutworm (*Euxoa tessellata*).

various weeds, plum, apple, pear, and cherry. In confinement it feeds freely upon grass, clover, buckwheat, box-elder, and the fleshy weeds. It is not on record as especially injurious to corn, being evidently a garden species rather, and my own observations support this statement. Cook found it injuring corn in Michigan, and Fitch in New York, the latter treating it in his Ninth Report under the name of the corn cutworm.

It is essentially a northern species, very abundant in the northern United States and Canada, but less common in central Illinois and southward. The caterpillar hides in the earth by day, cuts off the plants by night about half an inch above ground (and not below the surface, as do the Hadenas), and drags the leaves into its hole to feed upon them during the day.

There is but one brood a year, and the cutworms pass the winter about half grown, becoming most destructive in the latter part of May and the first of June. The moths (Fig. 54) are most abundant early in July. They have been taken in Iowa from early June to the beginning of August, and in Canada during the latter half of July and all of the following month.

THE BRISTLY CUTWORM.

Mamestra renigera Steph.

This is a small yellowish-gray species (Fig. 55) about an inch [in average length when full grown, marked by two blackish stripes, one on each side, with an unusually broad pale dorsal area between them. There are other less conspicuous stripes and lines, and the hairs are coarse and long, giving the caterpillar a bristly appearance.

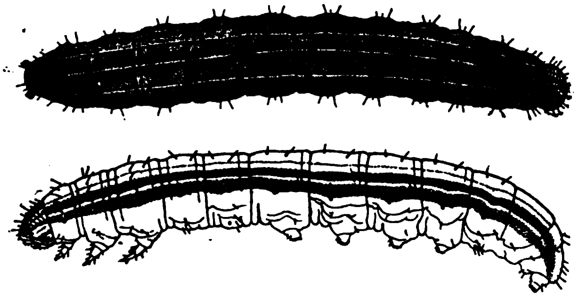

FIG. 55.—Bristly Cutworm (*Mamestra renigera*), back and side views. Enlarged.

This abundant little cutworm has been occasionally found by us at the base of injured corn plants, but it is mainly a grass and garden species, the spring brood of the caterpillars getting their growth too early to injure corn materially. It feeds mainly on the roots of its food plants, especially on garden flowers. The food plants listed are clover, the common grasses, chicory, turnips and comfrey, to which we add corn and cabbage. Gillette reared specimens on cottonwood leaves and alfalfa.

This species is found from Canada to Georgia, Colorado, and New Mexico, and it has been reported as very abundant in Iowa, Illinois, Ohio, and New York.

There are two generations each year, one of which hibernates as a cutworm partially grown. We have taken young larvæ at frequent intervals from Dec. 2 to April. Injury to crops by this species is most serious in central Illinois in the latter part of April and early in May. The cutworms pupate during May, and the moths (Fig. 56) appear in the latter part of that month, continuing common until the middle of July. Representatives of the second brood of cutworms have been found in early August, and the second brood of moths begins to appear late in that month and contiuues through

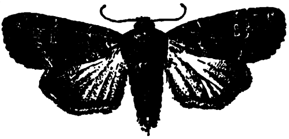

FIG. 56.—Adult of Bristly Cutworm (*Mamestra renigera*). Enlarged.

September and into early October. In Kentucky the first generation of the moths was reported present from April until after the middle of June, and the second generation in August and September. In Iowa the moths are said to be most abundant in June, and again about the end of August. In Canada the first generation begins to appear late in June.

THE SOD WEB-WORMS OR ROOT WEB-WORMS.

SEVERAL SPECIES OF CRAMBUS.

Every observer of insect life has noticed as he walks through grass on lawns or meadows in summer, multitudes of small white or grayish moths (Fig. 58, 59) rising before him, flying a short distance and then lighting to rest on the grass, head downward, with the body parallel to the blade. These moths, or millers, if examined when at rest, are seen to have the wings folded around the body in a way to give them a cylindrical form instead of the usual triangular one of ordinary moths. These are the parent insects of small, slightly bristly, reddish caterpillars which live abundantly in the turf, hidden away by day in a silk-lined burrow among the roots of the grass, but becoming active at night, when they feed especially upon the underground part of the stem of the plant, sometimes also upon its roots or blades.

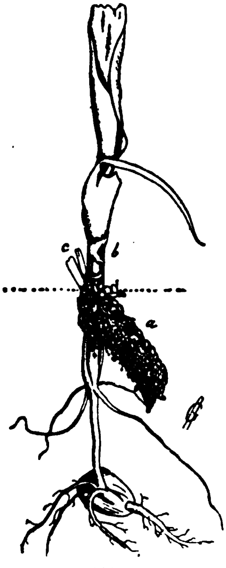

FIG. 57.—Web (*a*) at base of young corn plant containing larva of Sod Web-worm (*Crambus*); *b. c.* injuries to leaf and stem.

General Description.—These caterpillars average about half an inch in length when full grown, are pinkish red or brownish and covered with rows of comparatively smooth dark spots, from the center of each of which springs a rather coarse hair. They differ from cutworms in their habit of quickly wriggling away when picked up or disturbed and making active efforts to escape. Cutworms, on the other hand, are sluggish, and take disturbance quietly, simply curling up and taking their chances.

Injuries.—Not infrequently the web-worms become so abundant as to cause brown or deadened spots in a lawn or meadow, sometimes, indeed, in seasons unfavorable to the growth of grass, deadening the turf as thoroughly as white grubs or cutworms can do. When land so infested is planted to corn, this plant is very likely to be heavily injured, or even completely destroyed over considerable areas in early spring. The injury done is somewhat like that due to cutworms, and is largely under ground. but, on the other hand, the stems are rarely completely severed until the whole plant is eaten up. Commonly the first injury to the plant is done by gnawing the outer surface beneath the ground and about the roots. Then the caterpillar works upward, eating a superficial furrow or burrowing lengthwise along the center of the stem. The leaves are also frequently eaten, the lower ones first, and then the upper ones. The tips are eaten off, or irregular elongate holes are eaten through the blades. The injury being done at night, search must be made for the author of it by day by digging around the affected hills. The web-worms will commonly be found just below the surface (Fig. 57), each in a retreat formed by loosely webbing together a mass of dirt, more or less cylindrical in shape, an inch and a half to two inches long and about half an inch through. Within this mass is a silk-lined tube opening at the surface of the ground next to a stalk of corn, and within this specially prepared domicile a single caterpillar is secreted. Injuries due to these web-worms are commonly attributed by farmers to cutworms, and the caterpillars themselves are similarly confounded. This error would signify but little except for a single important difference in the midsummer life history which has its bearing on the proper time of plowing the sod in spring, and that for planting or replanting the corn. Cutworms are never protected by an underground web, are much larger than web-worms, make no active efforts to escape when disturbed, but curl up and remain inactive, and are without rows of conspicuous shining spots upon the body, these being represented by small and inconspicuous ones.

The injury to corn by the sod web-worms is not uncommon in fields planted on sod ground, and as it begins quite early and may last some weeks, it is fully as serious as a similar attack by cutworms or white grubs. Frequently more or less extensive replanting is required, and sometimes whole fields are completely destroyed two or three times in succession. In Ohio, for example, hundreds of acres of corn and oats were as completely killed in 1895 as if burned over, and similar injuries to corn have been reported from New York, New Jersey, Delaware, Maryland, Illinois, Iowa, and Nebraska. In Illinois and Iowa it was a most serious corn pest in 1887, destroying corn on sod ground in many fields distributed through several counties in both these states; and in Pennsylvania it was found destructive to corn in 1891, most injurious here as elsewhere, in one case at least, on old timothy sod. Besides its occasional injuries to corn, and to small grain where this follows upon grass—a rare event, indeed, at least in Illinois—its principal injuries are to grass in meadows and pastures. Its injuries here are much greater than are commonly attributed to it. "This fact is due," says Dr. Felt, "to its very insidious methods of work,"

"Unless the damage they do is very serious it is hardly noticed, or, if noticed, attributed to other causes. As the larvæ live a retired life, close to the surface, eating mostly at night and remaining in their nests during the day, they are rarely seen. Like most larvæ they feed most voraciously just as they are completing their growth; consequently, when the damage is noticed most of the larvæ are hidden in their retreats where they pupate. In these places none but an experienced entomologist would find them, or would think of associating the damage done with the harmless appearing moths that fly later.

"Hardly any farmer would think seriously of the loss of only one stalk of grass in ten, yet the aggregate for the country at large would be enormous. Not only is the damage to a crop where nothing short of a serious injury would attract attention, but the damage is distributed throughout the growing season. As a general rule, each species is most destructive at a different time from the other species of that locality; hence, species of *Crambus* prey upon the grass as a succession of small armies. Could the loss caused by these species come at one time in the year their destructive power would be better appreciated. Less than a third of the species may be classed as of economic importance, but these possess a capacity to cause almost infinite loss if the conditions are favorable."

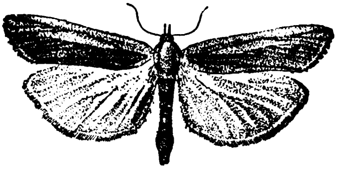

FIG. 58.—Adult of Common Sod Web-worm (*Crambus trisectus*). Slightly enlarged.

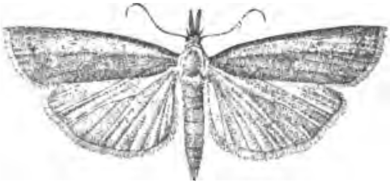

FIG. 59.—Adult of Striped Sod Web-worm (*Crambus mutabilis*). Enlarged.

Four species have thus far been bred from corn, namely, *Crambus trisectus* Walker (Fig. 58), *C. luteolellus* Clem., *C. mutabilis* Clem. (Fig. 59), and *C. vulgivagellus* Clem.

Besides the injuries to corn, grass, and oats already mentioned, wheat and rye have been injured by *vulgivagellus*, tobacco by *luteolellus* (*caliginosellus*), and cranberry by *hortuellus*, a species not yet reported from corn.

There are about sixty species of the genus *Crambus* in the United States. So far as known they are of very similar habit, and it is quite likely that any of them living habitually on grass will injure corn if this is exposed to their attack. The species notably injurious to this crop will consequently depend, in all probability, upon those which happen to predominate in the grass at the time the field is plowed, and as these predominating species differ from year to year, the list above given is not to be regarded as final.

Life History.—The biology of the species has not been sufficiently studied to give us a comparative knowledge of their life histories, although existing evidence indicates a difference in the species with respect to the number of annual generations, which varies from one to three in a season in the same locality. It is possible, however, that ampler data would remove this impression.

So far as known, all pass the winter in our latitude in the caterpillar stage, apparently not full grown. In early fall they close the mouths and thicken the walls of their cylindrical silk-lined nests before going into hibernation. In the spring they come forth, complete their growth, pupate near the surface, and later emerge as adults. "The eggs," says Dr. Felt, "are usually, if not always, allowed to fall at random in the grass. They hatch in from ten to twenty days." Eggs of various species have been obtained by us from June 9 (*trisectus*) to July 22 (*hortuellus*), and these have hatched in from ten to fourteen days. Most of them were laid singly, but occasionally in clusters of five or six. When first laid they are nearly white, but they change with age to yellowish orange. The young caterpillars form their web-lined nests immediately upon or just under the surface of the soil, strengthening them by the addition of bits of grass or particles of dirt to the surface. They commonly cut off the blades of grass and draw the ends down into the nest so that they can feed without leaving it.

The data concerning the life histories of the various species are not sufficiently complete for all to warrant general comparative statements concerning them. It is certain that two of the species, *trisectus* and *mutabilis*, are at least two-brooded. A tabulation of the dates of collection of a very large series of adults made in several successive years, shows two well-marked periods of maximum occurrence, one in July and one in August, with a comparatively sparse showing towards the middle of July. Larvæ of *trisectus* have been found abundant in May and early June, and again in late July and early August. Those of *mutabilis* are commonest in the latter half of June. The fact that a third wave of abundance of the moths of *trisectus* was noted one year in early October suggests the possibility of a third brood of this species at least. *Vulgivagellus*, on the other hand, appears to be a single-brooded species. The larvæ mature late in May, but remain, as a rule, in their underground cells, like some cutworms, dormant through midsummer, emerging as adults in August and September. The eggs are then laid for the hibernating brood of the caterpillars, which will be found in young corn most abundantly during the latter part of May and early in June.

The data concerning *luteolellus* also indicate, so far as they go, a single brood, the moths appearing most abundantly in June, and July, with only scattering occurrences in August, and none in the later months. Our breeding-cage results are likewise consistent with this supposition.

The points of especial economic interest in the life histories of these various species are virtually the same as in the case of cutworms. It is desirable to know at what time in fall the eggs are laid for the hibernating brood of caterpillars, since this will fix the time when grass-lands should be plowed as a preparation for corn planting the following year. It is also desirable to know at what time in spring the hibernating caterpillars cease their work, and when eggs are laid for the next generation. The first of these dates fixes the time of planting or replanting corn on infested land, and the second determines when grass-lands may be plowed in spring to the best advantage if the sod was not broken up the preceding year.

Prevention and Remedy.—The facts concerning these web-worms all admonish the farmer to break up a grassy turf as early in the fall as practicable preliminary to planting the ground to corn; the middle of September is as late as safety permits. If, however, this is not done until spring, it may best be postponed, so far as web-worm injury is concerned, in most cases, until the latter part of May. If an infested meadow or pasture is plowed earlier than this, when the larvæ are still young, they will probably live to attack the corn when it appears; and if plowing is postponed later, until the first brood of moths have emerged, they are likely to lay their eggs in the grass before plowing, and thus to give origin to a brood of caterpillars which, being quite young when the corn comes up, will make a long continued attack upon it, against which replanting will be of no avail.

THE BURROWING WEB-WORMS.

Anaphora popeanella Clem.
Pseudanaphora arcanella Clem.
Hypoclopus mortipennellus Grote.

These species are mentioned here merely to distinguish the larva of this group from the other web-worms, which it resembles somewhat in habit and injury to corn. It inhabits, however, a vertical cylindrical burrow penetrating the earth to a depth varying from six inches to two feet or even more. It is about the size of a common cutworm, but differs by its dull velvety surface and its colors, varying from silvery gray to brown, by the rows of polished spots on the body, and by its greater activity and more loosely jointed structure.

THE STALK-BORER.

Papaipema nitela Guen.
(*Hydrœcia nitela*, *Gortyna nitela*.)

This well-known caterpillar, often called the "heart worm" because of the character of its injury to corn, may be at once known wherever it is seen by

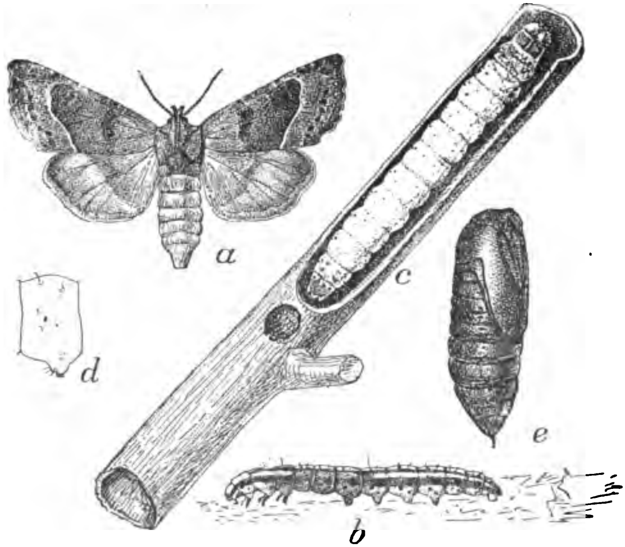

FIG. 60.—Stalk-borer (*Hydrœcia nitela*): *a*, adult; *b*, half-grown larva; *c*, mature larva in burrow; *d*, side of one of its segments; *e*, pupa. All slightly enlarged. (Chittenden, U. S. Dept. of Agriculture.)

the peculiar break in the striping of the body at the middle (Fig. 60, *b*). It is about an inch long when full grown. The general color varies from purplish brown to whitish brown, according to age, and it is marked with five white stripes, one running down the middle of the back, and two on each side. These side stripes are interrupted, being absent on the first four segments of the abdomen, giving the larva an appearance as if it had been pinched or injured there. The stripes nearly vanish as the larva matures (Fig. 60, *c*). The head and top of the neck, and the leathery anal-shield at the opposite end of the body are light reddish yellow, with a black stripe on each side.

Its presence in a young stalk of corn is very clearly indicated by the wilting, breaking down, and death of the top, and by the presence of a round hole in the side of the stalk (Fig. 60, *c*), plugged with the brown excrement of the caterpillar within.

It infests a great variety of other plants in a precisely similar way. It is most noticeable in early spring in blue-grass, by roadsides, or around the borders of a field, its presence there being betrayed by the whitening of single heads of the grass while all the rest of the plant is green. At this time it is of small size, and finds sufficient food within the grass stem; but later it is compelled to resort to thicker-stemmed plants, and it is at this time that it may appear in fields of corn.

Going in usually from outside the field, its injury is, as a rule, almost wholly confined to the outer rows. It rarely does any serious general damage to corn, although it is reported to have once destroyed fifteen acres of that crop near Elmira, Illinois, and it has also been occasionally found injuriously abundant in fields of wheat. It is probable that where the injury is not limited to the margins of the field, but is general throughout its area, the eggs were laid in fall in grass or thick-stemmed weeds in corn fields, where these have sprung up profusely after the corn has been laid by. The burrow which the stalk-borer makes within the stem runs upwards from the entrance opening, and of course varies in size with the growth of the larva. Sometimes in leaving a stalk it makes a new hole above that by which it entered, and it may in this way burrow in succession several different stalks and several different kinds of plants. Corn is injured by it while from two to ten inches high.

Besides the corn, wheat, and blue-grass already mentioned, it may infest oats and timothy, various garden crops—including potatoes, tomatoes, rhubarb, and spinach—blackberry and raspberry canes, the thick-stemed weeds—such as ragweed, burdock, and cocklebur—a considerable variety of garden flowers, and also the new growth of the peach, currant, grape, apple, willow, etc. Indeed, its food plants are so numerous as to indicate a practical indifference to kinds, the only necessary condition being a relatively thick stem, soft enough to allow it to enter and feed freely within. In the small grains and larger grasses, like oats and timothy, it makes its presence manifest by killing or even cutting off the stem within an ensheathing leaf, thus causing the head and the whole plant above the injury to turn white, and presently to dry up. It is only one of several insects which produce this general effect at this time, but its own injury may be at once distinguished by the round hole which it leaves in the stem of the infested plant.

It occurs throughout the United States and Canada east of the Rocky mountains, but is most destructive in our own latitude, the adult moth having been, in fact, originally described from specimens sent from Illinois to France.

The caterpillar, when full grown, pupates, as a rule, within its last burrow, commonly below the opening at which it entered—seemingly a precaution against its destruction by the withering and breaking away of the upper part of the injured plant. The pupa (Fig. 60, *e*) is light mahogany-brown, about three fourths of an inch in length and bears at the tip of the body a pair of spines. From it comes out a fawn-gray or mouse-colored moth (Fig. 60, *a*), with the outer third of the wings paler and bordered within by a whitish cross-line. Other specimens (var. *nebris*) have some white spots on the disks of the wings. The moth is nocturnal, and has been taken by us flying about electric lights and also at sugar. The eggs have not as yet been found.

There is but one brood in a year, and by the end of June the caterpillars are over half grown, and have mostly left the grasses in which they made their start and entered the thicker-stemmed plants, of course including corn. They live in this stage until late in July, when pupation begins, but larvæ have been found until Aug. 28. The moths begin to appear about the middle of August and continue throughout September and October. They have never been found in hibernation, and it seems likely that they lay their eggs in fall in grass-lands, and that these hatch in fall or the following spring.

The stalk-borer is much infested by parasites, both dipterous and hymenopterous, access being got to the caterpillars, doubtless, during their intervals of wandering while outside the infested plants.

Fortunately, injuries by this insect are not of a kind to require special measures of prevention or remedy. It is, of course, impossible to poison the larva in the corn field, and the breeding habits of the insect are not such as to enable us to destroy it in the pupa state by any ordinary operation. If headlands and other grassy lots adjoining corn show in early spring an unusual abundance of the insects, it might be worth while to mow the infested turf and carry away and feed the cut grass promptly, before the caterpillars could escape to enter the corn.

A number of other stalk-borers besides the one especially referred to in this discussion, occur in Illinois, all closely related to the preceding, extremely like it in general appearance, and injuring vegetation in an identical manner. Their life histories, so far as we may infer from scattered observations and breeding-cage notes, are practically the same as those of the common species. None of them have been noticed in corn, although some of them may easily have been confused with *nitela* in corn-field collections. These related stalk-borers differ from *nitela* especially in the fact that the longitudinal lines are less developed in some of the species and more so in others.

THE ARMY-WORM.

Leucania unipuncta Haw.

(*Heliophila unipuncta.*)

This notorious entomological raider and marauder, although one of the most destructive of the insect pests of American agriculture, is actually noticed and distinguished by individual farmers only when it becomes so numerous as to travel in companies, that is, once in some ten or fifteen years, or so, in any given locality. Indeed, many Illinois farmers of several years' experience have never seen the army-worm at all to know it, and many more would not recognize it with any certainty, if found within their fields and meadows, until it got practically beyond control. It is often very desirable, however, that its presence in grass-lands should be detected before it has begun its career of general destruction, and a good and plain description of it is consequently very much to be desired.

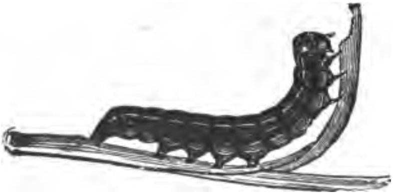

FIG. 61.—Army-worm (*Leucania unipuncta*), natural size.

This caterpillar should be looked for especially in the coarser, ranker grass growing in the lower, moister parts of the meadow. In the latitude of central Illinois, it appears in three broods or successive generations each year; the first about the middle of May, the second during the latter part of June, and the third in August and September. But one of these generations is seriously injurious during the same year, sometimes the first and sometimes the second, while the third, with rare exceptions, is economically insignificant. The earliest generation (May and early June) is most likely to be the destructive one in southern Illinois, and the second generation (late June and early July) in the central and northern parts of the State. The third generation (August and September) has never been injurious, to my knowledge, in Illinois, but has sometimes been so in New Jersey and New York. The abundant generation moves in hordes or "armies" out of its breeding grounds and into adjoining fields, destroying virtually every green thing as it goes.

Description of the Army-worm (Fig. 61).—This caterpillar has the general appearance of a cutworm, to which, in fact, it is closely related, and whose habits and injuries to vegetation it imitates in ordinary years when it is not unusually abundant. It is readily distinguished, however, from ordinary cut worms by its much more distinctly striped markings, in colors ranging from light greenish yellow to greenish black and black. Looking at the side of the caterpillar, one sees three such stripes very distinctly marked, of which the central one is dark, and the others are lighter. The back of the caterpillar is greenish black, and along the middle of it runs a narrow white stripe, broken and usually indistinct except at each end. Of the three side stripes, the lower one, which is just below the spiracles, is light greenish yellow and is narrowly edged with white. The upper one is a little darker, also edged with white, and with its center greenish black. The middle one of these three stripes, which has the spiracles at its lower edge, is black, sometimes a little lighter along its center. The head is of a greenish brown color, with coarse black mottlings, and with blackish lines where the pieces of the head seemed joined together. The belly of the larva is lighter than the back and more or less mottled with blackish. This description applies quite closely to ordinary examples. Sometimes, however, paler specimens are found, in which all the colors are less intense, but the pattern is unchanged.

The Army-worm Moth (Fig. 62).—The army-worm hatches from eggs laid by very common night-flying moths. These are yellowish brown, with a white speck near the middle of each fore wing. They are fond of sweets, and may be captured in large numbers at night by using sugary substances as a bait.

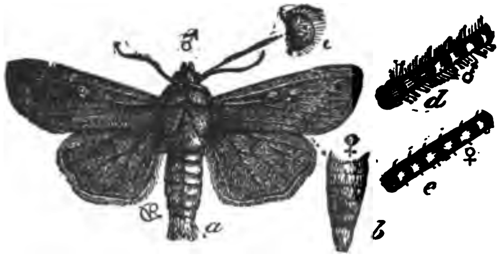

FIG. 62.—Army-worm moth (*Leucania unipuncta*); *a*, male; *b*, abdomen of female, natural size; *i*, eye; and *d*, *e*, male and female antennæ, enlarged.

Habits of the Army-worm.—Army-worms are present every year, and are among the most numerous of our native insects. When present in only ordinary numbers they feed singly in grass-lands like cutworms, remaining hidden during the day, and are then little likely to be seen. Indeed these stripes and colors make them difficult to distinguish among their food plants, and their habit of dropping when disturbed serves still further to conceal them. Their ordinary injuries thus pass unnoticed and their presence undetected unless the grass is so badly damaged as to turn brown in patches, when a close examination may disclose them in their retreats.

Their traveling habit, which has given them their name, can scarcely be called normal to the species, since they resort to it only under circumstances which are, for them, little less than desperate. When, by extraordinary multiplication, they become so numerous in their breeding ground as to devour their own food supply before they have attained their growth, they must search for more food elsewhere. Unlike many insects under similar circumstances, they exhibit a gregarious habit, and instead of dispersing separately in every direction, as would seem to be the more rational course, they move off together in a definite direction in almost solid phalanx, putting themselves thus to the serious inconvenience of traveling great distances to find their necessary food, and exposing themselves likewise to wholesale destruction by birds and other enemies and to wholesale infestation by insect parasites. Fortunately for agriculture, they likewise expose themselves by this same act to destruction by the farmer, who can annihilate a compact mass of traveling caterpillars. although he might be helpless against their attack if they separated and dispersed to all parts of the compass.

Feeding ordinarily upon grasses, they prefer these and grass-like grains, even on their desperate marches. They seem to eat with almost equal relish blue grass, timothy, wheat, oats, corn, rye, and barley, and will likewise readily take sorghum, Hungarian grass, millet, and flax. In confinement they have grown and completed their transformations when fed exclusively on poppy, beet, lettuce, cabbage, raspberry, onion, parsnip, radish, carrot, or pea, but have declined cotton and grape. Ordinarily clover is not eaten by them. and it is said that the timothy in a mixed field is often eaten to the ground, leaving uninjured the clover scattered through it. A remarkable exception is reported, however, from New Jersey, where in 1880 clover was generally eaten by army-worms in some localities. In the field. besides the plants above mentioned, they have also eaten cranberry, strawberry, bean. sugar beet, sweet potato, parsley, watermelon, cucumber, apple, pepper, honey-suckle, ragweed, wild *Solanum*, and amaranth.

When they enter a field of young corn they first climb up the plants, eating the blades of the leaves on each side of the midrib, but presently, as they become more abundant, they may virtually devour the whole plant to the surface of the ground. "Fully to realize the destructive capabilities of this insect," says Slingerland, "one must see (no description will suffice) an army of the worms on the march and at work. In most cases the caterpillars in each of these armies must have been numbered by the millions; even an approximate estimate of the worms of a single army would have been impracticable. Oftentimes when an army was marching across a lane or roadway, nearly the entire surface of the ground for several rods would be covered by a mass of worms; one could not step without crushing several of them." They feed mostly at night and on cloudy days, although not by any means refraining from travel and feeding in bright weather.

Geographical Distribution.—The army-worm is apparently a North American species, and was well known in New England before the Revolution, where. indeed, measures for the arrest of its movements were adopted which are still the best we can suggest. The species is now distributed throughout nearly the whole world, but it is only in the United States east of the Rocky Mountains and in Canada that it multiplies to a number such as to compel its movements *en masse* in search of food. It is particularly abundant throughout the region from Iowa and Maine to Texas, Alabama, and North Carolina, and in this region there is rarely a year in which it does not somewhere become numerous enough to do serious injury.

Life History of the Army-worm.—The yearly history of the species is not fully known as yet, some diversity of opinion prevailing as to the stage in which it hibernates. Many accurate observations on this subject relate to partly grown caterpillars found late in fall, winter, or early spring, and hibernation in this stage seems to be a somewhat general occurrence. On the other hand, we have taken the moth in March in Illinois, and have once seen it common at lights on April 11. It is also said by Prof. John B. Smith to have been found in New Jersey during the entire winter in sheltered places. We have seen no satisfactory evidence of its hibernation in the pupa stage, although this fact is likewise asserted by some.

When a brood of the caterpillars becomes full grown they rapidly disappear, entering the ground an inch or so, and forming there smooth cavities by twisting about, or making a slight cocoon under clods or other shelter. There they change to smooth brown pupæ (Fig. 63) from which later the moths emerge.

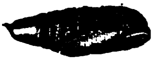

FIG. 63.—Pupa of Army-worm (*Leucania unipuncta*). Natural size.

The eggs for the first generation are laid, in our latitude, about the middle of May. These hatch in from eight to ten days. The life of the caterpillar is twenty to thirty days; that of the pupa, twelve to fifteen days; and the moths begin oviposition about a week after they emerge. This gives about seven to eight weeks for the life cycle in midsummer. The eggs are placed by the mother moth behind the surrounding sheath of the leaf of grass or grain, from ten to fifty or more together, imbedded in a gummy substance which fastens them also to the leaf surface and closes the sheath around them. It is said that "early in the season the moths prefer to oviposit in the cut straw of old stacks, in haystacks, and even in old fodder stacks of corn, or in old bits of cornstalks scattered about in pastures." Eggs have also been found in the spring in young grain. Slingerland reports that as many as 737 eggs have been found in the body of a single moth—a fact which goes far to account for the tremendous power of reproduction exhibited by this insect.

Until after the second molt the young caterpillars have the looping habit of the measuring-worms, and spin down at the end of a thread when disturbed, as do the canker-worms. They often leave their feeding-grounds when they are scarcely more than half grown. They may travel at the rate of five to ten rods an hour.

Prevention and Remedy.—The fact that two successive generations of the army-worm are never injurious in the same locality is due to the sudden check placed upon their multiplication by a concentration and increase of their enemies of various kinds, the most important of which are insect parasites and parasitic diseases. Birds and ground-squirrels gather for their destruction, but these larger animal enemies are rarely numerous enough to produce any very marked effect upon the traveling horde. Their insect parasites and fungous diseases, on the other hand, presently come to affect them so generally that they perish wholesale either before or after entering the ground for pupation, the soil in such cases stinking with their decayed remains. Parasitic insects have been seen to swarm about them in such numbers that the sound of their flight was like that of a hive of bees.

In case by watchfulness and good luck a farmer detects a colony of army-worms before it has left its native field of grass or grain, he may to advantage surround it by a few deep furrows so plowed that the dirt shall be thrown inward towards the colony, and then either kill the caterpillars as they collect in this furrow in their efforts to escape, or poison them in a body by spraying the vegetation on which they feed with an arsenical poison, like Paris green.

To stop them and destroy them after they have taken up their line of march, deep furrows are plowed in front of them. The straight side of each furrow, which should be the side away from the worms, is trimmed, if necessary, with a spade so that the dirt shall be perpendicular or overhang a little, and post-holes are made in the bottom at intervals of ten or fifteen feet where the caterpillars may collect in quantity as they travel up and down the furrow seeking to escape. Here they may be readily killed by pouring a little kerosene upon the struggling mass in each post-hole, after which they should be shoveled out to make room for another collection.

Prompt and vigorous action is essential to success, since the presence of these insects is often not detected until they are well under way, and their rate of movement is such that acres of corn may be sacrificed by a few hours' delay.

THE CORN BILL-BUGS.

Sphenophorus parvulus Gyll.
S. venatus Say. (*S. placidus.*)
S. ochreus Lec.
S. pertinax Oliv.
S. cariosus Oliv.
S. scoparius Horn.
S. sculptilis Uhl.
S. robustus Horn.

The corn "bill-bugs" are snout-beetles of various size and color (See Fig. 65 and 66), but averaging rather large, the majority of them dull black, with the surface much marked with small pits and narrow grooves. In form they are somewhat irregularly oval, with thick bodies, rounded above and beneath, and with rather long and thick "snouts" or "beaks" of medium length, curving downward from the front of the head. This so-called snout is really a part of the head itself, and bears always at its tip a pair of minute jaws or mandibles, used in taking in food. The beetles injure and often kill young corn in spring by thrusting the beak into the stem of the plant near its base and eating out the inner tissue beneath the point of puncture. Their presence in the field is very soon made manifest by the appearance of circular or oblong holes running in rows across the blade of the leaf, each row resulting from a single thrust of the beak when the leaves were closely rolled together in the young plant. The injury done varies from insignificance up to complete destruction of practically every plant in several acres of corn and for two or three successive plantings.

The larvæ of these beetles (See Fig. 64) are rarely found in corn fields except in some of the southern states, where one of the species, *robustus*, may live as a larva in the pith of the stalk. The others feed, in the larval stage, so far as known, upon the bulbous roots of grasses, sedges, and the like, or, in the smaller species, upon the fibrous roots of the smaller grasses. These larvæ are thick-bodied, oval, footless grubs, with hard, brown or blackish heads, the first segment behind the head being leathery and smooth and slightly tinged with brown. They are most frequently seen imbedded in the root-bulbs of timothy, or, in swampy situations, in the thick root-bulbs of the common reed, the club-rush, and other very coarse sedges and swamp grasses.

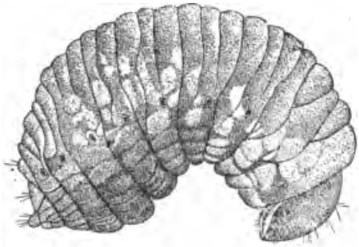

FIG. 64.—Larva of Corn Bill-bug (*Sphenophorus ochreus*), side view. Greatly enlarged.

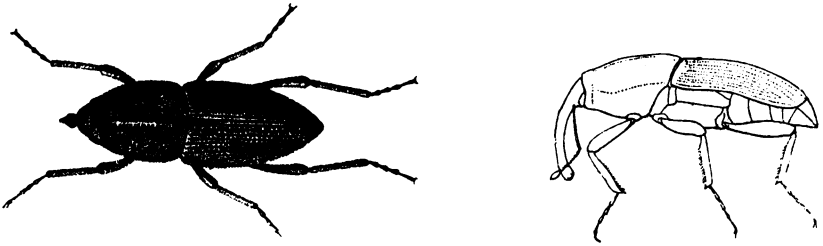

FIG. 65.—A Corn Bill-bug, (*Sphenophorus parvulus*), back and side views. Greatly enlarged.

Injuries to Corn.—With the exception of the southern species mentioned above, the injuries to corn are done entirely by the beetles, and are commonly limited to the first year after grass. In some cases where freshly drained swampy tracts have been broken up, the injury may continue in diminished quantity the second year, provided that the crop has not been sufficiently well tilled to kill out thoroughly all the coarse native sedges and grass-like plants. The adults of all the species feed in substantially the same manner, as far as observed, and inflict a similar injury on the plants they infest. Placing itself head downward, with its stout legs embracing and firmly grasping the stalk, the beetle applies the tip of its beak straight against the surface, cutting the outer tissue with the jaws, the action of which is distinctly audible. Gradually, with an occasional twisting motion of the head, it sinks two thirds or more of its snout into the stalk, and then, slightly rolling its head from side to side with clock-like regularity, it uses its beak as a lever to split the stalk and pry the edges of the slit apart. It pauses from time to time to eat out the soft tissues within, and by moving forward and backward and twisting to the right and left, it hollows out an interior cavity much larger than the surface injury would indicate. Then, pulling the head strongly backward with the compressed beak inserted, the stalk is split upward as a boy would split a stick with a knife. In this way a slit an inch long may be made in the stalk of corn, beneath which all the softer parts have been eaten out.

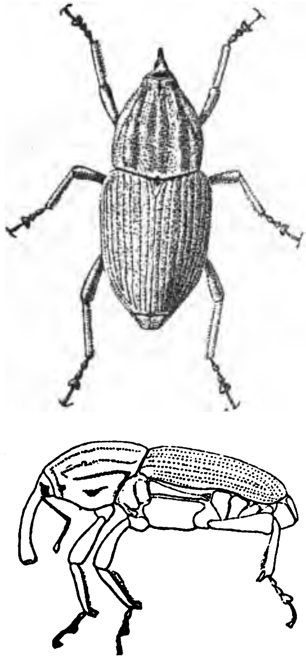

FIG. 66.—A Corn Bill-bug, *Sphenophorus ochreus*, back and side views. Greatly enlarged.

The injury thus done varies in position from a little below the surface of the ground to the middle or upper two thirds of the larger leaves. The beetles are often seen at work on young stalks, head downward, with the beak inserted its full length. They are always on the lower part of the plant, from an inch above the ground to a little below it, and two or three of them are sometimes seen on a single stalk. They are not easily alarmed when thus engaged, and a plant may even be cut away, if care is used, without disturbing them. Although they cling closely to it, they can readily be picked off with the fingers, and when thus detached they do not seek to escape, but feign death for a little time.

The effect on the corn plant of such injuries varies according to the size and number of the beetles. A small species like the abundant *parvulus* (Fig. 65) may do little more than to leave a trace of its visit in the form of a series or two of oblong parallel holes across one of the leaves; but the larger species, especially if several beetles attack the same plant, may so rag and deform the young leaves that no ear is matured, or may kill the plant outright.

While there is in Illinois a little general and unclassifiable injury to corn by the bill-bugs, by far the greater part of it occurs under one of three conditions. If swamp lands are broken up from grass in spring and planted to corn the same year, and especially if the common reed or the club-rush or other thick-stemmed grasses with bulbous roots are common in the turf, the corn is extremely likely to be badly injured if not wholly destroyed by one of the swamp-loving species of this group. If such land is poorly cultivated, allowing these bulb-root grasses to grow up again, the injury may continue for at least another year. If an old timothy-sod, either pure or mixed with some other grass, is plowed in spring and planted immediately to corn, this crop is likely to be severely injured by other and smaller species than those which attack the crop in swamps. I have known but one case of any considerable injury by these insects to a field of corn in Illinois, except under one of the above conditions.

The damage on swamp sod is frequently so serious and extensive as to require the repeated replanting of large fields of corn. On timothy sod it is not often so complete, a badly infested field rarely having as much as fifty per cent. of the plants injured, and these less seriously because the bill-bugs breeding in timothy average much smaller than those living in swampy situations.

Injuries to Grass and Grain.—The injury to timothy meadows by the work of both beetles and larvæ is sometimes considerable, the former killing the stalk, and the latter destroying an entire stool by hollowing out the bulbous root.

In West Virginia, according to Hopkins, injuries by one of these beetles (*sculptilis*) are among the prime causes of the early decay of timothy meadows. One of the smaller species, *parvulus* (Fig. 65), has also been reported as slightly injurious in the larval state to wheat, oats, and barley. The grub feeds within the straw until it becomes too large for its burrow, and it then passes to the roots, often killing an entire stool of grass in this way.

Distribution.—The known distribution of these beetles is very general throughout the United States and Canada, and in Illinois they may occur anywhere within our boundaries if local conditions permit them to breed.

Life History.—So far as known to me, all our bill-bugs pass the winter in the beetle stage on the ground under rubbish or in other protected situations, and all whose life history has been closely observed, make their appearance in spring usually in fields in which they have lived as larvæ, and where they have fed on the roots of grasses or grass-like plants the preceding year. As the adult beetles feed on the same plants as their larvæ, there is little to tempt them to migrate from one field to another, and the known facts clearly indicate that they pass the winter, as a rule, in the same fields in which they went through their earlier stages, provided that these fields have been undisturbed. All whose life history has been traced with sufficient fulness to warrant an opinion are apparently single-brooded, although the long breeding period and the frequency, as a consequence, with which the insects may be found in various stages at the same time have sometimes led to the inference that there were several generations in a year. Injury to corn, however, is in all cases limited to spring and early summer, ceasing altogether by the middle of July even in the most serious cases. Corn not killed or crippled by these insects while it is young soon grows beyond their reach, and they then leave the field in search of more practicable food.

The eggs of the Illinois species studied are laid mainly in May and June in the roots or stems of the plants; larvæ may occur throughout June, July, and August; and the beetles emerge in late summer and in fall.

Measures of Prevention and Remedy.—Probably no steps could be taken to arrest the injury to corn in spring by these beetles, and the only resource at that time must be replanting of the injured hills. To avoid repeated destruction, this should be postponed as late as practicable, but it would be virtually safe after the middle of June. The swamp bill-bugs are likely to continue their destructive work through June and well into July, and with them, consequently, this measure would usually fail, and the only alternative remaining is the planting of the ground to some crop not liable to injury by these beetles. It appears from observations made in 1902, that injury by the swamp species may be forestalled by breaking up the sod in early fall, and it has also been repeatedly observed that corn growing upon timothy sod of early fall plowing was relatively—usually, indeed, completely—free from bill-bug injury the following spring.

For details concerning the several species the reader is referred to an article on the corn bill-bugs published in my Fifth Report, the sixteenth of this office (1890), and to another on "The Corn Bill-bugs in Illinois," in my Eleventh Report, the twenty-second of the office (1903).

THE CHINCH-BUG.

Blissus leucopterus Say.

This notorious insect, one of the very worst enemies of American agriculture is, on the whole, the most destructive to corn of all the insect species to whose attack that crop is subject. It is true that in some parts of the State it has now been virtually unknown for many years, and that where it is most commonly destructive, periods of several years may succeed each other with no noticeable loss to the corn farmer on its account. There are considerable districts, however, in which it is permanently present in numbers sufficient to do every year more or less injury in corn fields, varying from what may be described as trifling to the total destruction of the entire crop over many square miles of territory. It is estimated that the total agricultural losses due to the ravages of this insect have amounted in single states to from $10,000,000 to $20,000,000 in a season, and throughout the whole range of the insect to $100,000,000 or more in a single year.

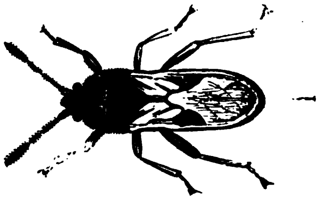

FIG. 67.—Chinch-bug (*Blissus leucopterus*), enlarged as indicated.

It must be admitted, however, that the weather conditions under which its injuries become serious are such that the corn would suffer materially from drouth if it were not infested by chinch-bugs at all, and as the effect of the insect attack is virtually indistinguishable from that of excessive dry weather, it is usually quite impossible to separate the effects of these coöperating causes. Estimates of injury by chinch-bugs are therefore exceptionally uncertain.

Description of the Chinch-bug.—Although this insect is so abundant and destructive at certain times and places, its appearances in numbers sufficient to attract attention are often separated by intervals of many years, and multitudes of farmers consequently do not know it at sight.

When full grown (Fig. 67) it is readily distinguished from any other insect of its region by its size and form, and by the peculiar distribution of the white on its back. Looked at from above, the outline of the entire insect is an elongate oval with rather straight sides and broadly rounded ends. Its length is three twentieths of an inch or a little less, and its breadth about a fourth as much. The head and thorax are black, and all the surface is minutely hairy except that of the wings. The wing-covers, which conceal the abdomen, are milk-white, with a triangular black scutellum between them in front, and a black blotch at about the middle of each side. These invasions of the white area give it roughly the form of the letter X, and this cross mark of white on the back is the characteristic mark of the species. In winged specimens which have recently changed by molting from the preceding stage, the black of the above description is represented by a dull pink, the wing-covers, however, being wholly white, with pinkish veins.

The chinch-bug molts four times after hatching, and changes its appearance materially with each molt. There are thus five distinguishable stages, the first three of which together are often called the red stage of the insect.

In the first of the red stages (Fig. 68*c*) the young chinch bug is pale red throughout, with a band of yellowish across the base of the abdomen.

In the second stage (Fig. 68*e*) the red of the head and the prothorax changes to a dusky tint, and the abdomen becomes a bright vermilion with a pale yellow band across its base and with faint dusky patches on its posterior segments.

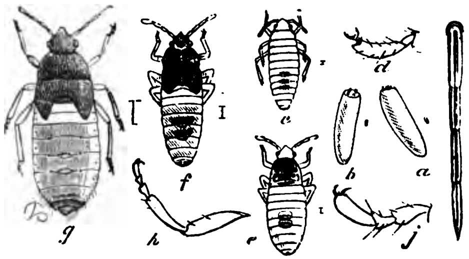

FIG. 68.—Chinch-bug (*Blissus leucopterus*): *a, b,* eggs; *c, e, f, g,* the four successive immature stages; *i,* sucking beak of adult. All much enlarged, as indicated.

In the third stage (Fig. 68*f*) small rounded pads appear on the thorax, projecting backward in the place of the future wings. The head and the thorax are wholly black or dusky and the abdomen is a dusky red with a patch of darker red near the middle, the light band across its base still remaining, although partly concealed by the wing-pads at its ends.

In the fourth stage (Fig. 68, *g*) the original red color has wholly disappeared, the general tint varying from dusky gray behind to black in front, with a remnant of the pale band across the base of the abdomen showing behind the much enlarged wing-pads. This is sometimes called the pupa stage, and is, of course, the next preceding that of the winged insect.

The egg (Fig 68, *a, b*) is a very slender oval, about .03 of an inch in length, rather narrowly rounded at one end, and slightly docked or squared at the other, where, under a high magnification, four small rounded tubercles may be seen. Its color is at first whitish and translucent, but later darkens to amber, and finally, as the insect develops within, becomes definitely red.

Food Plants and Injuries to Crops.—The chinch-bug injures all the grasses and creal crops, but is strictly limited for food to plants belonging to the grass family and to certain wild sedges. It is most destructive to wheat, and next, probably to corn, although it is likely to damage oats very severely. It infests the meadow and pasture grasses generally, and may destroy them as completely as any other crop; but owing to their perennial growth they afford in spring much less fresh and succulent herbage than the young and delicate plants in fields of corn and wheat. Where spring and winter wheat are grown in the same region, the chinch-bug is more likely to destroy the former, mainly because spring-sown grain is exposed for a longer time to chinch-bug attack before it is harvested. The chinch-bug never injures clover, the cowpea, or any forage crop which would not commonly be recognized as grass; neither does it injure potatoes, beans, or fruiting plants of any description.

There is probably never a year in which the chinch-bug does not injure grass or some cereal in some part of its territory. It is, however, subject to very wide fluctuations in number, becoming at irregular intervals a pest of such frightful character as to appal the agriculturist, and reduce whole districts to temporary poverty. It has, indeed, modified in important ways the agriculture of large sections of our country, leading to the permanent abandonment of wheat culture in many counties of Illinois, and forcing in others the use of leguminous forage plants in place of the grasses and a substitution of orchard culture for the raising of grain and grass.

There is no very definite regularity in the recurrence of its periods of greatest destruction. These are, however, clearly dependent on the periodicity of the weather, injury by the chinch-bug reaching its maximum after several dry years, and being suspended by the occurrence of two or three wet years in succession. The chinch-bug period is, however, less definite and tangible than the weather period, since not every such change in the weather is followed by a notable corresponding change in the chinch-bug situation. The rise and the fall of a wave of chinch-bug abundance occupy unequal times, the period of annual increase being longer than the period of decline. Three or four or even five years of notable injury to crops may succeed one another, each worse than the preceding, before the maximum is reached, and then, within a year or two, hordes of these insects which may seem to have taken permanent possession of the fields and meadows over an immense district may disappear so completely that it will be difficult to find a few living specimens.

The injuries by this insect are done by sucking the sap from the plants. Being without jaws for biting, it can only appropriate fluid food by piercing the tissues of its food plant with the hair-like stylets of its beak, and then sucking out the sap from the lacerated cells. Owing to its immense numbers, it may so rapidly drain a strong and thrifty corn plant a foot or two in height that this will wither and fall to the ground as if cut off at the root.

Life History of the Chinch-bug.—The points of special economic interest in the life history of the chinch-bug are the stage and place of its hibernation, and the method of its escape from fields of wheat and other grains at harvest time. It passes the winter as a full-grown winged insect among the roots of tufted grasses; under stones on grassy knolls; under leaves, sticks, logs, and bark; in thickets and the borders of woods; beneath the rails and boards of fences, and in similar sheltered situations. From these winter quarters it emerges in spring, the exact time varying according to the weather, flies freely about in every direction and to considerable distances, settles most generally in fields of wheat, the young growth of which affords it an abundant and attractive food, deposits its eggs there on the ground about the base of the plant, on the roots a little under the surface, or sometimes on the lower part of the plant above ground, and presently dies. The eggs are thus laid. in central and southern Illinois, during the last days of April and the whole of May. They begin to hatch about the middle of the latter month, and by the middle of June the old chinch-bugs which had wintered over are virtually all gone.

At harvest time the young of the new generation are in various stages of development, due to the fact that the eggs are laid at intervals through a period of about a month. There are at wheat harvest some winged bugs in the field, but the great majority of them are of ages varying from those just hatched up to the stage preceding the last molt. Forced out from these fields of small grain by the ripening of the plants and the consequent pressure of starvation, they enter fields of oats and corn adjoining in a continuous throng, making their migration almost wholly on foot. They thus concentrate in overwhelming numbers on the plants at the borders of the newly entered field, draining and killing everything as they go. It is at this time that the principal injury to corn is done, and it is the method of this migratory movement which gives us our special opportunity to protect the corn by destroying the invading army.

When the majority of the brood have acquired wings, flights of the adults occur, resulting in their dispersal through the field. The eggs for a second generation are laid most commonly in corn fields, particularly on roots of grass-like weeds growing among the corn. This second generation of the year reaches the winged stage late in August and early in September, and leaves the fields in search of winter quarters from the middle of the latter month to about the middle of October.

It should be noted, however, that none of these movements are made simultaneously by all the chinch bugs of a locality. Even the movement from the winter quarters is a gradual one, and in some cases the chinch-bugs have not all placed themselves for the laying of their eggs before the oats are sown, or even by the time the corn is planted. These crops are consequently likely to become somewhat infested in spring by the first generation of the year, even though there may be an abundance of wheat growing also at the time.

If the weather is very dry at harvest, and especially if drouth and the abundance of the bugs have combined to kill both grain and grass-like weeds by harvest-time, chinch-bugs will desert such fields almost as fast as they can get out of them. If, on the other hand, the grain ripens gradually and normally, and the stubble is left with green weeds interspersed, the bugs are likely to linger for days and even for weeks before the harvested field is completely free of them.

The effect on corn varies with the gravity of the attack. Often in the migration movement every plant of several rows next an infested field of wheat or oats will be blackened by the invading hordes. In such a case the corn is completely killed, and the bugs move forward row by row, carrying the injury, it may be, from one side to another of a field of twenty or thirty acres, and leaving scarcely a living stalk behind. Where they are less abundant, however, they are commonly to be found first and most numerous behind the boots or sheaths of the leaves, where they drain and possibly kill the lower leaves of the plant, checking but not fully arresting its growth.

The second generation, hatching in the corn-field, does much less injury to corn than the migrating one, not because it is less numerous, but because it is more widely dispersed, and also because the corn plant is larger and more thrifty at that season of the year, and can support a loss of sap which would be fatal to younger plants.

A serious minor effect of chinch-bug infestation during the latter part of the season is a consequence of the clustering of the bugs about the base of the stalk of corn where the so-called brace-roots are putting forth. The growing tissues at this point are then so drained of sap that these roots do not develop, and the corn, lacking their support, falls to the earth in the first heavy wind, and often fails to form a perfect ear.

Preventives and Remedies.—Without attempting to give in this special article any full program of procedure for the restriction of chinch-bug multiplication or the protection of crops against it, three measures will be discussed as particularly applicable to the corn crop.

A considerable mass of evidence has been accumulated, of both a popular and scientific character, to the effect that the growing of wheat is favorable to the chinch-bug. This is seemingly due to the fact that the wheat plant offers in April and May a perfect food to the adult, and likewise to the delicate young as they hatch from the egg, whereas, if this crop is not grown, the bulk of the hibernating bugs must distribute themselves over the meadow grasses, only the later ones establishing themselves in fields of oats and corn. The grasses seem at this season of the year to afford a less abundant and perhaps less nutritious food than does the young wheat plant, and general chinch-bug injury of the first or even of the second grade is rare in districts where no wheat is raised. The abandonment of wheat culture is too drastic a measure, however, for general use, since it would result in the obliteration of that crop over a great part of the so-called wheat belt in the central and north-central states.

The hibernating habit of the insect suggests at once the advantage of what is commonly known as clean farming—the destruction, that is, of all waste and rubbish of every description which may form a winter protection to hibernating insects, and the burning over of all waste places and accumulations of rubbish in early spring before the bugs have scattered abroad. The maintenance of thickets and of woodlands with their coating of leaves and masses of fallen brush is especially favorable to these hibernating insects, and an old rail fence will afford winter harborage to millions of them.

The main dependence of the corn farmer, however, must be the destruction of the bugs as they seek to enter his corn after the ripening of the small grain has forced them to migrate in search of food. As soon as the ripening of badly infested fields of small grain compels the chinch-bug to desert them, if the weather is dry so that the ground may be thoroughly pulverized and kept in a dusty condition, a strip of ground six to ten feet wide should be deeply plowed along the side of the infested field adjoining corn. This strip should then be thoroughly and deeply pulverized, first with a disk harrow and then with a brush, until it is reduced as nearly as possible to the condition of dust. Next a short log eight or ten inches in diameter, or a triangular trough made by nailing two boards together, and afterward loaded with stone, should be dragged endwise back and forth in this strip, the driver riding the log or trough if necessary, until a deep groove or furrow has been made across the line of march of the chinch bug host. The sides of the furrow should be dressed here and there with a hoe, as may be needful to make sure that no passageway out is left for the chinch-bugs which will presently accumulate in the bottom.

If the furrow has been well made, its dusty sides will prove impassable to the bugs which tumble into it, especially as these move at this time almost wholly on foot. If it is so placed that it is directly exposed to the sun in very warm weather the great majority of the chinch-bugs caught in it will be speedily killed by the heat, the youngest succumbing first, but even adults finally perishing. Nevertheless, to insure their destruction, holes a foot in depth should be made in the furrow with a post-hole digger at intervals of about twenty feet, to serve as traps for the bugs. Here they will accumulate by pints and quarts and even by pecks in a place according to the number in the traveling horde, and in these holes they may easily be killed by pouring a little kerosene upon them. The post-hole digger may be conveniently used for removing them when dead and for dressing up the holes again.

As the myriads of bugs attempt to escape from the furrow, climbing its dusty wall again and again with desperate persistence, they will gradually lessen the slope by dragging down the dust as they fall back, and some of them may thus make their way out in time. It is consequently necessary that the barrier should be continuously watched and occasionally rectified here and there with a hoe. After a time it will perhaps be most convenient to make another furrow parallel with the first, abandoning the latter or using it for the coal-tar strip presently to be described.

This furrow and post-hole barrier will work to practical perfection so long as the ground can be kept thoroughly pulverized, but even a slight shower of rain is sufficient to destroy it, releasing the imprisoned chinch-bugs and giving free passageway into the threatened field. Consequently, if the weather is moist, recourse must be had to the coal-tar line which, laid upon the surface of the ground and occasionally renewed, operates as a complete barrier against the movement of the chinch-bugs. As a preparation for this line a hard well-beaten path must be prepared into which the tar will not readily sink This should be about level with the adjacent surface or a little above, as otherwise the line is likely to be buried by dust and rubbish blown upon it. The effectiveness of the barrier depends indeed largely upon the preparation of the strip of earth along which the tar is to be poured. This may be conveniently made by plowing a back furrow and beating the ridge thus formed flat and hard with spades. The comparatively loose earth will at first absorb the tar somewhat freely, but a crust will presently form of earth saturated with the tar and afterwards dried out, and this will receive fresh additions without absorbing them. This line must be renewed from time to time as it becomes dry, a process ordinarily requiring to be repeated from three times a day to once in two or three days, according to the weather. Along this strip post-holes must be dug in which the chinch-bugs will be caught, even though the ground may be thoroughly wet. Short lines of coal-tar are usually laid leading obliquely outwards from these holes, in order to steer the chinch-bugs into them when they approach the tarry line. A single man or boy can guard from eighty to one hundred and fifty rods of such barrier continuously. In the holes the bugs may be killed by using either kerosene or coal-tar, as is most convenient.

This method may seem troublesome and costly to the reader of this description, but the actual expenditure of labor and money is practically insignificant as compared with the loss of crops which may thus be prevented. Such a coal-tar barrier kept up for a fortnight will commonly protect a field completely, and the average cost for tar at three dollars and a quarter a barrel (the current price in southern Illinois) will be twenty-five cents a day for a line of a hundred rods in length.

If, as a consequence of mismanagement or accident, chinch-bugs succeed in crossing this barrier or enter the corn before it is made, they will accumulate upon the nearest rows, where they may be killed at slight expense by spraying or sprinkling the plants with a mixture of kerosene and soap-suds known as the kerosene emulsion. This is made and applied as follows:

Dissolve a half-pound of soap (hard or soft) in a gallon of water by boiling. Remove from the stove and add two gallons of coal-oil and mix thoroughly by pumping this fluid back into itself by means of an ordinary spray pump. When the emulsion is formed it will look like buttermilk. To each quart of this mixture add fifteen quarts of water and sprinkle or spray upon the corn, preferably before 10 o'clock a. m. or after 3 o'clock p. m. The bugs should be washed off so that they will float in the emulsion at the base of the plant. A teacupful to a hill is generally sufficient, but the quantity must vary with the number of bugs infesting the corn.

In the absence of the mixing pump the kerosene and soap-suds—two parts of the first to one of the second—may be thoroughly mixed by a violent beating with a stick for about five minutes, the vessel containing the fluid being covered with a cloth to prevent spattering. Emulsions so prepared, although less stable than those made with a pump, will stand for at least two hours without any appearance of a separation of the oil and water, and will do no damage to the corn if diluted to contain but 4 per cent. of kerosene. If more than this proportion be used injury to the plant is likely to result. The mixture may be applied in any convenient way; even flirting it on the corn with the hand will serve the purpose perfectly.

The cost of material per acre of corn treated, will be about 70 cents where the plants are practically covered with chinch-bugs, and about 30 cents per acre where it is moderately infested.

By the use of these various measures corn can be effectively protected against chinch-bug injury, and if so handled, will become infested only by flying bugs which, having been allowed to mature, are scattering over the country in search of food and a place of deposit for their eggs. Even this injury, if serious enough to demand treatment, may be arrested by the use of the kerosene mixture just described.

GRASSHOPPERS.

ACRIDIDÆ.

Injuries to corn by grasshoppers are rarely sufficient in Illinois to require special attention. These insects do not breed in corn, but come into it, if at all, from grass-lands near by. They first injure the outer rows by eating away the silks and kernels from the tip of the ears and by eating up the blades of the leaves, sometimes devouring the husks of the young ear. The effect of the first injury is to prevent the fertilization of the kernel, thus blasting the ear. At long intervals, when a series of dry years has favored the multiplication of these insects, they become locally destructive in midsummer to grass and small grain, and later to corn. Under these circumstances several of our native species may fly from place to place for short distances in considerable swarms, imitating in a small way the habits of the notoriously destructive Rocky Mountain locust. This latter species does not occur in Illinois, and no grasshopper injury to which we are subject approximates that which sometimes overtakes the agriculturist of the western states. Our Illinois grasshoppers are subject to destruction by a multitude of enemies, which become, of course, more numerous as the grasshoppers themselves increase in number. As a consequence, two "grasshopper years," so called, rarely succeed each other in the same locality.

The standard means for destroying grasshoppers has been until quite recently the use of a long, narrow, shallow pan or tray of sheet iron, commonly called a "hopper-dozer," with a high back of iron or cloth, dragged across the field by hand or by horse power, after a little kerosene has been placed in the bottom of the pan. Recently, however, a poison mixture particularly attractive to grasshoppers is taking the place of this apparatus, and is doubtless more likely to be used in Illinois wherever active measures against these insects are found necessary.

This mixture, known as the Criddle mixture, is composed of one part, by measurement, of Paris green to 120 parts of horse droppings, preferably fresh; or about a pound of Paris green to half a kerosene barrel of the droppings, with a pound of salt additional if the material is not fresh. Enough water is added to make the mixture soft without being sloppy, and it is then scattered about the field in quantities according to the number of the insects, which will be attracted to it for a distance of forty feet. This poison is most effective when fresh, but it will do excellent work when several weeks old.

In speaking of the use of the Criddle mixture, Dr. Fletcher, Dominion Entomologist of Canada, says: "In this section all used the poison and only a few acres of crops were destroyed. I am convinced that had we begun the test earlier, hardly a bushel of grain would have been lost. It is not exaggerating to say that dead locusts could be gathered up in wagon loads, and at times be smelt a half mile."

The ordinary method of making and using the hopper-dozer is thus given in the Third Report of the State Entomologist of Minnesota, that for 1897:

"A sheet of ordinary sheet-iron, such as is used for making stove pipes, is turned up one and a half inches around the edges and riveted at the corners. This makes a shallow pan about eight feet long, two feet broad, and one and one half inches deep. To the bottom of this are riveted six small strips which can be fastened to the three runners on which the pan rests. To the rear side of the pan is screwed a light wooden frame, as long as the pan and one and one-half feet high. Over this frame a piece of canvas is stretched. This frame serves the important office of throwing back all those locusts that otherwise jump clear over the pan, and to throw them into the oil. The runners on which the pan rests are usually made from saplings or small pieces of boards having an upward curve in front to prevent them from catching in the ground. The front ends of the runners are all fastened by screws to a cross-piece, which is, in turn, drawn by two ropes, one at each end. These ropes are joined in front and fastened to a singletree. Sometimes two hopper-dozers are fastened to a long pole by means of short ropes; this is very easily drawn by one horse. Just in front of the pan is fastened a piece of rope which sweeps the ground a few inches in advance and serves to stir up the hoppers and make them jump into the pans. In the pan is laid a piece of cloth, which is first thoroughly saturated with water. About a pint of kerosene oil is then thrown in and the upright sheet or sail of canvass is also moistened with it. The machine is drawn over the fields or wherever the locusts are thickest. In a short time it is usually partially filled with dead or dying insects.

"The slightest touch of kerosene oil, either from the pan or from the canvas sheet behind it, means death to the locust, for the oil spreads over its body in the same way that a single drop of it will spread over a large surface of water. . . . A very large proportion of the locusts that come in contact with the oil in the pan immediately jump out again, but they invariably die in the course of a few seconds or minutes."

The various species of grasshoppers injurious to corn in Illinois are so similar in their habits and life history that it is not necessary for any practical purpose to distinguish them, but all may be treated, so far as the corn crop is concerned, as a single economic group. It may be of some interest to know, however, that the most abundant species in corn is the red-legged grasshopper (*Melanoplus femur-rubrum*). With it is ordinarily associated the heavier and more sluggish olive grasshopper (*M. differentialis*), with a sprinkling of the two-striped grasshopper (*M. bivittatus*). In the southern part of the state the lesser migratory locust (*M. atlanis*) and the large conspicuous bird grasshopper (*Schistocerca americana*), also become abundant, and, like the species *femur-rubrum*, sometimes collect in considerable swarms and make short flights across the country.

THE EAR-WORM OR CORN-WORM.

Heliothis armiger Hubn.

This insect, known also as the cotton boll-worm, the tobacco bud-worm, the tomato-worm, etc., is a slender, nearly hairless caterpillar (Fig. 69, *c*) an inch and a half to two inches long, varying in color from light green to brown, and marked with alternating light and dark stripes and lines running lengthwise of the body. A common type has a dark brown stripe down the middle of the back, with a fine white line in its center, and bordered on each side by a pale brown stripe, and below the latter a distinct whitish stigmatal stripe. Inconspicuous shining tubercles, each bearing a delicate hair, are arranged in transverse rows on each segment of the body. The head is amber yellow, and the legs are dark.

As an ear-worm this caterpillar feeds on the corn beneath the husk, from the time the ear is formed until after it is thoroughly ripe, and it also eats the husk, the leaf, the tassel, and the tender stalk. Although it probably prefers corn to any other of its food plants, it is likewise fond of cotton, tobacco, beans, and the fruit of the tomato, and feeds freely upon a great variety of other plants, including pumpkin, squash, peanut, pea, cow-pea, hairy vetch, pepper, okra, jimson weed (*Datura*), asparagus, ground cherry, hemp, morning-glory, gladiolus, mallow, mignonette, geranium, sunflower, poppy, and peach. It sometimes devours soft-bodied insects, such as the cabbage-worm and cotton-worm, and has been known to eat the young of its own kind even when vegetable food was plentiful. As a bean insect its injuries in the south are of the most serious character, whole crops being destroyed, and it is also one of the standing and most destructive pests of cotton and tobacco. In the truck garden its injuries to green tomatoes are notorious, although in this work it is aided by a number of other kinds of caterpillars.

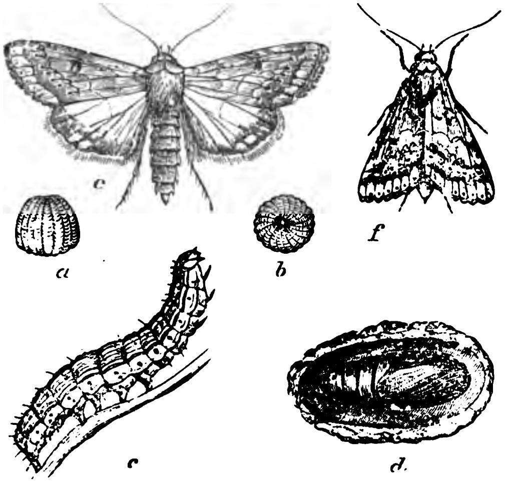

FIG. 69.—Ear-worm (*Heliothis armiger*); *a, b*, egg, side and top view; *c*, larva; *d*, pupa in cell in earth; *e, f*, adult. Natural size.

It is a cosmopolitan insect, being now found in virtually every part of the world. It is very common in Illinois, where it is most widely known because of its injuries to green corn in the garden and to field corn, particularly in the southern half of the state.

Early in spring it feeds on corn leaves, filling them full of holes the size of small shot, and later in the season it enters the tips of the ears, gnawing away the silk and eating out irregular winding channels among the soft kernels, thus often making its way down below the middle of the ear. A single caterpillar does not confine itself to a single ear, but leaves its work of destruction to be continued by other insects and by fungi, which are likely to follow up its injuries. It bores a round hole through the husk at the side of the ear, and infests others in succession. There are sometimes two or three caterpillars in the same ear, but in that case they are commonly of different ages.

There are three annual generations of these caterpillars in the North, and in the South from four to six, besides a series of broods preceding these, which come from a few individuals that pass the winter as adults. The species hibernates in the pupa stage, and emerges to lay eggs in early April. These range from two hundred to five hundred in number for each female, and are shaped like an inverted teacup (Fig. 69, *a*, *b*), with the vertical ribs converging towards the apex and broken up by concentric grooves into little knobs. The caterpillars reach their growth in from two to four weeks, and the moths (Fig. 69, *e*, *f*) appear about two or three weeks later. The first brood of caterpillars in Illinois feeds on the leaves and the tender shoots of corn, the second brood devours the tassel, the silk, and the ear, and the third infests the hardened ear. The fourth and fifth broods, where they occur, all attack various plants, particularly the cotton-boll in the South. A sixth generation is reported from Texas. The caterpillar enters the earth for pupation to a depth of from two to five inches, where it forms a slender cocoon by lining the end of the burrow with a few threads of silk (Fig. 69, *d*).

The mastery of this pest in the corn field is still an unsolved problem. It is believed that late fall plowing of corn fields which have been infested by this insect will destroy it in the pupa stage by breaking up its underground shelter and exposing it to the vicissitudes of the weather. It is not often practicable, however, to plow corn ground in fall in Illinois, and the effect of such a measure at best can only be to diminish the number of moths in the neighborhood the following year.

CLASS IN DOMESTIC SCIENCE—UNIVERSALIST CHURCH.

Mrs. S. Noble King, Bloomington, Superintendent of Class.
Prof. Isabel Bevier, University of Illinois, Instructor for Tuesday Morning.

STUDIES IN BREAD MAKING.

Miss Bevier told of the need of a standard by which bread may be judged, a measuring unit, a something which shall be to the girls' study of bread what the score card for corn is to the boys' study of corn, and what the butter score is to the work of the butter judge. A general resume was given of the making of the first score card for bread. The idea of a score card seemed to spring from a need felt in different parts of the state at about the same time. The Illinois Association of Domestic Science in session at Decatur, in February, 1904, asked the household science department at the University of Illinois, to arrange a score card to govern the making of bread and creating a bread standard in Illinois.

A few months later a score card was submitted, and now after a partial test of its value, it was hoped to get together a number of women who make bread and to discuss the merits, perhaps the flaws, in this card. To flavor 35 points are given. The question arose as to whether flavor is of the most importance.

A number present gave opinions. Mrs. King believes baking to be the first requisite. Mrs. Challacombe and Mrs. Francis consider flavor first. Mrs. Waterman thinks the flavor depends largely upon the baking. Miss Anna Barrows believes the baking and flavor almost inseparable. "Cut a loaf through the middle and you can tell at once if it is sour or not well baked."

Another lady said she believed that baking should come first, though flavor is influenced or ruined in baking too little or too much. Mrs. Harpham, of Havana, cited an instance of a bread contest in which the bread was judged entirely by the crust. This is the baker's test.

In order to arrive at a definite conclusion, Miss Bevier asked for a vote on each point of the score card. Flavor, lightness, and grain and texture are the controlling points. "Flavor means everything," said Miss Bevier, "flavor of the wheat, of the flour. Flavor in good bread is not derived from anything which we put in the bread. Flavor is kept best without salt, sugar or lard, and when the fewest of these are added."

Lightness—Perhaps the real question of lightness will have to be settled by the weight by volume. One pound of flour will make 1¼ to 1½ pounds of bread. Miss Bevier has made 1.65. A German baker who to please his customers gives a large loaf, explained to Miss Bevier, "They wants all they can get for their money." For this reason the loaf is often raised until it barely escapes sourness.

Grain—little holes or large, and texture, are so closely related that they have not been separated. The things which influence the texture are the things which influence the flavor, as the season and the way the wheat is milled.

A vote, resulted in accepting the score card as it is.

Flavor	35
Lightness	15
Grain and texture	30
Crust—	
Color Depth Texture	5
Crumb—	
Color Doughiness	5
Shape and size	5
Moisture	5
	100

Ordinarily a pan 9x4x4 is considered standard.

A committee was appointed by the president to formulate plans for bread contests in the county institutes throughout the State. The committee are: Mrs. J. R. Challacombe, Hillsboro; Mrs. Frank Hall, Aurora, and Miss Lottie Jones, Danville.

A number of loaves of bread were brought to this meeting and a few practical ideas gained in bread judging.

A careful study of Miss Isabel Bevier's "Studies in Bread Making" in the Domestic Science Yearbook for 1904, will prove very helpful to those wishing to know more about bread as judged by the standard score card.

Miss Anna Barrows, Boston, Mass., Instructor for Wednesday Morning.

ALL SORTS AND CONDITIONS OF KITCHENS.

The history of our race is the story of the evolution of special arts and crafts, from the modest efforts of primitive man to increase his comfort, up to the modern demands of luxurious life. Yet every year shows us improvements in implements which we have admired for their perfection.

The use of fire to cook his food was one of the earliest points of distinction between man and the animals. Civilization is said to have begun at the hearthstone where man attempted to protect his precious fire. All architecture has been traced back to the chimney corner as well as many of our social conditions and laws.

As Ralph Waldo Emerson has said: "We must learn the homely laws of fire and water; we must feed, wash, plant, and build. These are the ends of necessity and first in the order of nature." These laws of fire and water govern the fundamental processes of our kitchens and we must learn to obey them before we can use our modern appliances. Other problems of the housekeeper are the same as those of the manufacturer, to utilize by-products, to lessen the cost of production and to save friction. They are benefactors of mankind who make two blades of grass grow where one grew before, but the need of American housekeepers is to learn to accomplish by one motion that which heretofore has required several.

There is much to be learned by a study of conditions of the past and the kind of kitchens which resulted. From pictures and descriptions we may bring before us such kitchens as that in Windsor castle, where the old-time roasting spits and modern gas stoves may be used in the preparation of the same royal feast, as well as the picturesque kitchens and primitive utensils of the half civilized races.

HINTS FROM BUSINESS KITCHENS.

The business kitchens of the large hotels and restaurants or the traveling kitchens of the ocean liner, or the dining car, or even the kitchen which must feed the hundreds of employés of a great circus, have many lessons for the housekeeper who must feed her family with the work of her own hands.

The school kitchens, in public and private schools and colleges, where lessons are given not only in the preparation of foods but in their economic and nutritive value, are serving as experiment stations for the housekeepers and helping them as much as the agricultural experiment stations aid the farmer.

LIGHT, VENTILATION, CLEANLINESS.

The kitchen once was living room as well, but gradually we have set aside other apartments for sleeping, eating, and meeting our friends, and left to the kitchen only the preparation of our food. Therefore, it need not be a large room, but it should be light, well ventilated, and every detail so constructed as to facilitate cleanliness. It should be easily shut off from the rest of the house yet near enough to save steps. Usually separate pantry and storecloset are desirable. The kitchen never should be the only passage way to other parts of the house. The average architect gives too little attention to the kitchen.

Basement kitchens, dark and half under ground, are not productive of clean, wholesome food. Investigation by experts in England and France, have shown that certain types of disease and undue mortality among cooks are doubtless due to bad air and lack of light in the kitchens where they work. In some modern hotels and club houses the kitchen has been placed in the upper story of the building.

WINDOWS AND WALL FINISH.

Special attention should be given to the windows of a kitchen, they should be opened readily both top and bottom, and if possible swing out.

The kitchen should be on the same level as the dining room, dumb waiters always demand more service.

The finish of walls and floors should be such as can be most easily kept clean. The modern hospital and dairy rooms give many hints in this direction. The schools of domestic science by providing instruction in chemistry and bacteriology are establishing new standards of cleanliness.

ESSENTIAL FURNISHINGS.

The essential articles of kitchen furnishings are the range, the sink. the tables and shelves, and unless these are placed in right relation to each other in accordance with the natural order of preparing and cleaning up after meals, much time and strength will be wasted by the one who does this work.

A coal or wood range should be supplemented by a small oil or gas stove for hot weather and emergencies. Near the stove should be lifters, pokers, shovel, holders, asbestos mats and a few of the sauce pans, etc., in most frequent use. A box to hold wood, kindling, shovel, and tongs, when required, should be close to the stove. The plainer the surface of the stove and range the easier to keep it clean.

SINKS ARE USUALLY TOO LOW.

The modern sinks shown in enamel and porcelain are proof of the evolution taking place in household appliances. The wooden sink with wooden spout, always damp and practically impossible to keep clean, a breeding place for bacteria, is still in existence in too many country dwellings, though gradually being superseded by those of iron, soapstone, slate, and porcelain finish.

Too often sinks are placed so low that the average woman has to stoop when washing dishes. The top of the sink should be at least three feet from the floor, though most carpenters insist on placing it several inches lower.

Business kitchens and some modern houses place the sink in the middle of the kitchen rather than against the wall. Wherever it is there should be ample shelf or table room near it. Shelves that slide in and out, or are hinged, are convenient where space is limited.

TABLES AND CUPBOARDS.

The kind and number of tables must vary with kitchen conditions, but several small ones are better than a single large one. Few tables are high enough to make work easy. Small two-story tables on castors are useful to move from place to place. A zinc covered table may receive hot kettles from the stove without injury.

A step ladder chair and a high stool are more useful kitchen seats than any other.

The patented kitchen tables or cabinets offer many advantages—but the woman living in a house of her own often does better to have a carpenter build a similar piece of furniture to fit her conditions.

Cupboards and dressers are usually more convenient without doors. Many cooking schools have adopted the open shelves with Holland shades before them.

The refrigerator is another type of cupboard or closet. Two small ones are usually to be preferred to a single large one. In one may be kept the raw food supplies like meat, and in the other near the dining room, food that is ready for the table.

DISCARD THE LESS USEFUL.

There is constant change in the utensils offered for sale, and a continual temptation is set before the bargain loving housekeeper, but we should select tools with more care than pictures even. Each new invention claims to be "the best thing yet," though when tried it may, or may not be, for patents are not all perfect. If our spring cleaning were thoroughly done each year, many a "useful invention" which failed to work, sundry articles of cheap tin which fell apart on using, and some old veterans which have outlived their usefulness, and are cherished for no other reason than the good they have done, would be sent to the ash barrel. The fewest possible things to care for is the ideal condition.

MUST HAVE PROPER TOOLS.

The lists of necessary utensils as given in the standard cook books are guides for a young housekeeper, but cannot be implicitly followed, since different households have differing needs. It is best, moreover, not to furnish too elaborately at first, expecting a kitchen thus equipped to stand for a lifetime without renewals. Rather plan to make some additions yearly as one does to a wardrobe or library, and thus take advantage of the really helpful new tools. Fashions in housekeeping change and the size of a family varies. The cooking schools have done much to show housekeepers that fine work in cookery, as in other arts, is impossible without proper tools. As the kitchens have grown smaller the utensils have become less cumbersome.

Housekeepers dependent upon servants often find it difficult to keep their kitchens properly supplied with utensils. Each new occupant calls for new tools and few know or care about keeping things in order. The day may come when cooks, like dressmakers and carpenters, will be expected to come supplied with their own tools. Any ambitious cook certainly would do well to own the choicer small articles. Where duties are specialized each worker should have necessary utensils instead of losing time and temper by attempting to use one set in common. So, too, it may save energy to have duplicate articles for use in different places.

It is absolutely essential that the housekeeper who does her own work shall be well supplied with labor-saving utensils and these only. She must not have useless or clumsy ones.

The question about any new kitchen utensils must be the same as with clothing. How much labor will be required to keep this article in running order? How will it wear? How will it wash? It is said that the majority of utensils in a Chinese kitchen are segments of a sphere, hence there are no grooves and seams to catch grease. One teacher of cooking is careful to choose utensils that are not noisy in use, another will not allow any in her kitchen of breakable material. Some of the most helpful articles are not high priced, but only the best quality of material is desirable. Cheap grades of tin are not profitable investments.

LIGHTNESS, SIZES AND SHAPES.

The weight of these appliances is an important consideration and the present tendency fortunately is toward lightness. Agate and similar kinds of ware have practically routed the heavy iron kettles, and now comes aluminum which is extremely light and offers other advantages.

For the average family small sizes are better than large, yet an assortment is best in common articles like sauce pans and kettles. Where closet room is limited a set of sauce pans fitting into each other should be chosen. Some kettles should be shallow with broad base. thus heating quickly for rapid cooking, others high with small base, suitable for slow cooking and taking up less room on the stove during the long cooking necessary for steamed puddings or soup-stock; in the main, deep rather than shallow. Be sure that the covers of all kettles fit closely. Nothing is more troublesome than an ill-fitting cover continually tipping into the kettle. Large agate pans or kettles are more convenient than large heavy earthen bowls for mixing bread and similar uses.

NEED SCALES AND RELIABLE MEASURES.

Scales and reliable measures are necessary to secure uniform results. A steam cooker is useful in a large family and an ordinary steamer should also be carefully fitted to one of the kettles. A trivet, or false bottom, for a deep kettle can be used with deep pans in steaming puddings and brown bread. Oval pans, known as Charlotte Russe molds, are convenient to put in a steamer, as two can be used at once. Time can be saved in steaming puddings by using individual molds, like corn cake cups or smaller ones.

A deep Scotch bowl is the best frying kettle, and a frying basket should be chosen to fit it. A small sheet iron frying-pan six or eight inches in diameter, is a most useful and inexpensive article. Agate or porcelain tea and coffee pots and double boilers have many good points. Flavors are preserved much better than in tin dishes. Perforated tin and agate pie plates are preferable to earthen, which usually crack and absorb grease. Gem pans having round cups are much easier to wash than the oblong ones with corners, and make a prettier shaped cake. Large loaf pans are undesirable. Bread or cake is more easily baked and every way more satisfactory when not over four inches through, however long the loaf may be. The central tube is a desirable feature in pans for puddings and light cakes.

KNIVES, FORKS, SPOONS.

Many housekeeps are crippled in their work by an insufficient supply of spoons, knives and forks. Too often those to be found in the kitchen are worn with the use of several generations, but these may be better than cheap articles of later date. There should be enough strong spoons to prevent any use of silver for scraping dishes or measuring. Wooden spoons are best for stirring custards and stewed fruits, and the slitted ones for cake making. The old fashioned, two-tined steel fork is undoubtedly the best kitchen fork. A long handled fork, with small tines, is useful in reaching into a steaming kettle.

There are many varieties of knives needed—small sharp knives with pointed tips, saw tooth knives for bread and cake, and many bladed chopping knives, boning knife, palate knife, or spatula. A strong can opener, like the sardine scissors, a good cork screw and an ice chop should be found in every kitchen.

MINOR FURNISHINGS.

Among the minor furnishings, yet essential to the housekeeper's comfort and to nice processes in cookery, are measure cups, a glass lemon squeezer, a wire egg whisk, a set of skewers, a cake cooler, a small wire broiler with guards on the sides, a wire vegetable masher, a potato ricer, and strainers of varying sizes and degrees of fineness. More expensive articles, but helpful in large familes, are the meat and fruit presses, combination flour bin and sieve, and meat choppers. A clock and scales are essential to exact results. Scissors, needles, pins, string, paper for lining cake pans, cloths for various purposes are as necessary as any utensils already named.

Wooden utensils are less common than in the days of our grandmothers. The grinders are superseding the old chopping bowls and wooden bowls are rarely used for mixing doughs, since they absorb grease and odors and are liable to crack when wet. The mortar and pestle is not the necessity in the modern kitchen that it was in olden days when the spices must be powdered at home. The wooden lemon squeezer has had its day. The rolling pin and kneading board are usually made of wood though marble and glass has the advantage in coolness. The wooden spoon of the right shape is the one utensil of wood which can hardly be spared as yet.

PAPER UTENSILS.

This is a paper age in more senses than one, yet the use of paper for utensils or as a labor-saver in the kitchen is not as general as it should be. True, paper pulp and the like have been used for pails, tubs, basins and wash tubs; and confectioners deliver oysters, ice cream, pickles, pies, and even milk in paper cases. It is possible to carry milk some distance in an ordinary paper bag, and perhaps some ingenious scheme will be devised for delivering milk in cases which may be destroyed instead of going through the doubtful career of the usual milk can or jar. Paper dishes free from chemicals, so that they may be used for cooking puddings, pies, and escalloped meats and vegetables, and cheap enough to be burned after using, would simplify dish washing.

The multiplication of utensils adapted to each variety of food has so increased the length of the dish washing process that it is a question whether those inventions of the present day can counted as labor-savers. The orange spoon, the oyster fork, the nut pick, and the like may simplify the eating process, but involve the owner in much labor of cleaning and care-taking.

HIGHER INTELLIGENCE REQUIRED.

With improved appliances in the kitchen must come a higher degree of intelligence for both mistress and maid, and the trained worker will secure proper tools for her trade. Once let women learn to think in percentages, to count the cost of the different processes involved in cooking and serving food, and many labor-saving methods will be introduced in our kitchens, or processes now carried on there would be put out of the house to take advantage of the labor-saving tools available only where large quantities are to be handled. The laundry has thus begun to leave the individual home, and one only needs to visit a modern, well equipped laundry to see the wisdom of its separation from the usual routine of housework. An up-to-date creamery is another illustration along the same line.

BUSINESS WOMAN TO SOLVE PROBLEM.

To the business woman we must look to place our system of housekeeping upon a systematic foundation, for she has learned something of the laws of supply and demand, and understands human nature sufficiently to deal successfully with "the butcher, the baker, the candlestick maker." Through schools, clubs and business life women are learning the power of united action, the force of the word together. There are many possibilities for the future where electricity will be adapted to kitchen uses, both for cooking and as a motive power. At present it is a rather expensive luxury.

Present difficulties in securing kitchen helpers are due to many things, largely to the separation of the kitchen from the life of the house. With the bad air, lack of light and inconvenience of many kitchens, who can wonder that the mother and daughters are unwilling to work there, and that a high type of helpers cannot be secured?

WOMEN MUST PUT THEMSELVES INTO THEIR KITCHENS.

Women must put themselves into their kitchens, not only bodily, but with mind and soul, before this room can have its rightful place in our homes. The importance of wholesome and attractive food can hardly be overestimated, but with more studying of these subjects, the hours for the preparation may be shortened and the routine of living simplified, and yet each member of our household be better fed than ever before.

TEACH THE CHILDREN TO HELP.

All members of a family should be trained or encouraged to help in its care. Children especially are interested in what takes place in the kitchen and should be allowed to share in the home duties. As President King, of Oberlin college, has said: "To allow a child to grow up in idleness and selfishness at home is a hideous wrong, that even the most scientific analysis of his needs, and the most pedagogic meeting of them by a teacher, can never make good. A reasonable return to the use of home 'chores,' of which Charles Dudley Warner writes so feelingly in his 'Being a Boy,' would be a very distinct contribution to the real religious education of countless children. I doubt if there is any greater single need today in religious education in the broad sense, than the need that parents should take pains to see that children have some useful service to render daily in the home, and learn there some thoughtful, unselfish consideration of others."

Mrs. Gertrude C. Sober, University of Illinois, Instructor for Thursday Morning.

TEXTILES.

Fifty years ago when our grandmothers spun the yarn and wove the cloth, they knew cloth. Life was simpler and there were not the varieties of cloths to puzzle the purchaser; the names of various textures did not change with the seasons; there were certain standards and these standards were reverenced. To-day the change in industrial conditions has changed our attitude toward textiles. Women are no longer the producers but the consumers. That women are the consumers, and large consumers, we have but to visit the large dry goods stores to be most surely convinced. They are not alone consumers, but the purchasing agents for the whole family. Again, when we come to realize the millionaires made by some large stores, one graduating no less than half a dozen, we can comprehend to a small degree the amount spent by women as purchasing agents.

SHOULD KNOW THE BUSINESS.

No business house would consider a purchasing agent or business manager who knew nothing of his subject, yet how many women act in a similar capacity who have no knowledge of their business. Then from a business standpoint women should know something of the textile fabrics in market and their values both economically and esthetically. True, it seems like a hopeless task when we consider the extent of it, when we know that men spend a life time on one branch of the subject, say unbleached cottons, or black woolen goods. But we may certainly become more intelligent buyers and know a few points to help us, and by observation, study and thought save many dollars and gain in self respect by being honestly clothed.

It is impossible in one hour to do justice to even one part of the subject, but if I can convince you of the importance of the subject and so inspire you to further study, I shall feel the time is well spent. To-day, then, I shall take up the study of one of the textile fibers, wool, hoping next year you may study another, and in the meantime read everything you can find on the subject. Little is written as yet except the technical literature.

FOUR CLASSES OF FIBERS.

There are four fibers in general use, cotton, wool, linen, and silk. These fibers have been the "useful" fibers even before we have any historical records. The remains of pre-historic man shows evidences of weaving, and even the woven cloth is found, dating back many centuries before the Christian era. I shall classify them as animal—wool and silk; and vegetable—cotton and linen. Cotton is king. Cotton is working its way into the textile field, being used with each of the other fibers and even supplanting them.

WHAT MERCERIZING IS AND DOES.

I wish to speak today of mercerized cotton since it is now coming to occupy so important a place. Mercerizing is a process which changes the appearance of the fiber, causing it to resemble silk. The fiber is treated with a strong solution of caustic alkali. If a fiber so treated be examined under the microscope, it is seen to have lost all its characteristics. It is no longer flat and spirally twisted but is seen to be thick, straight, and transparent. An effect similar to this process is produced by corrugated cylinders, but this imitation does not hold its gloss when laundered. It can be told by holding the piece to the light, when the fine lines can be seen; or by washing and ironing the cloth, when the "silky look" disappears.

Mercerized cotton damask, now on the market, should be understood. Linen is unequaled for table use. Owing to a peculiar property, linen does not dye easily and for the same reason stains can be easily removed from linen. Cotton damask soon loses its purity and cannot equal linen for table use either in its wearing quality or beauty.

"WEIGHTING" IN SILK

Cotton and wool are the fibers of the masses while linen and silk are fibers of luxury. Still, since waste silk has been utilized as spun silk, and is so heavily weighted, silk is often sold cheaper than fine cotton. "Weighting" is put in almost all silk but the amount of weighting varies. This weighting causes the silk to crack, and some weighting causes it to wear "shiny."

CAN BE TOLD BY THE ASH.

The weighting can be seen by burning a sample of silk. Pure silk burns when held in a flame but when weighted it leaves an ash which often holds to the shape of the silk weave. Pure silk is beyond the pocketbooks of most of us, but we ought to know that silk is weighted, and certainly very cheap silk must be heavily weighted.

ONLY A YARD OF WOOL PER CAPITA.

We must consider wool, especially woolen yarns, today. They are made from new wool stock or woolen stock that has been used in the manufacture of cloth. The Textile Record of 1904 made the following statement: "If all the sheep's wool grown each year throughout the world were divided equally among the inhabitants outside the torrid zone, each person would receive nineteen ounces of wool, which, made up into cloth, would give each a piece of about one yard, inadequate to clothe the human being twelve months. The use of shoddy and cotton to supplement wool is a blessing to mankind."

EXTENSIVE USE OF SHODDY.

Shoddy is the woolen stock once used for manufacture of cloth. It is rags ground up. The Record still further says: "The strike of the coal miners would be of little consequence compared to a continued strike of the ragman."

If shoddy is used, if shoddy must be used, we ought to know its advantages and disadvantages. From the above quotation we can see its advantages. It brings comfort to the masses, since it supplies warmth and brings the price of cloth within their reach. There should be no unreasonable prejudice against shoddy. We should only know its limitations. There are 125,000,000 pounds of shoddy manufactured yearly in England alone.

DIFFERENT GRADES OF SHODDY.

There are different grades of shoddy. 1. Shoddy proper, the worked-up waste of soft woolen goods not milled and felted, stockings, flannels, merinos, etc. This is the best. 2. Mungo, made from hard spun felted cloth, from the clippings in tailor shops. This is free from cotton. 3. Extract wool, from waste materials having cotton or linen in them. 4. Flocks, waste from finishing machines. This is little better than dust. There is a saying that no wool is too short to be used again if it has two ends.

In considering the sources of the different grades we can see all shoddy is not alike. This shoddy is often mixed with new wool or cotton to give it strength, but sometimes the cloth made from shoddy has no tenacity. In buying you can tell the strength of the cloth by taking the warp and welt threads and testing them. By pulling you can easily see the length of fiber used in the stock.

THE FELTING PROPERTY OF WOOL.

Owing to the peculiar structure of the wool fiber, it can be worked up differently from the other fibers. We refer to its "felting" property. The fiber is covered with tile like projections which catch on each other when worked together. The finer wools have more of these serrations and are "kinkier" than the coarse wools and so are better adapted for felting finish.

Wool resembles hair, and human hair exhibits the markings of wool, but less distinctly. If wool is steeped in water it becomes softened and swells up considerably. This hygroscopic and elastic nature comes in play in the process of steaming, boiling, finishing, and stretching of yarn. The worth of wool depends on physical properties—softness, fineness, length of staple, waviness, strength, elasticity, flexibility, etc. The composition of wool is similar to feathers. Acids do not act readily on wool, and so the cotton in "extract" is separated from wool by steeping first in dilute acid when the cotton is carbonized. Alkalies act on wool injuriously, even diluted alkali, hence wools should be washed with soaps having no free alkali.

DIFFERENCE IN WOOLEN AND WORSTED.

I will speak of two general types of fabric made from wool fiber, woolen and worsted. The difference lies in the arrangement of fibers in the processes of manufacture. In woolen the fibers are arranged so as to be in every direction, and to cross and over-lap each other in such a way that they may present their serrated surfaces in the greatest variety of ways. In worsted the fibers are so arranged as to lie smoothly in the direction of the thread and parallel to each other.

PROCESSES WITH WOOL.

Wool for woolen is carded and never straightened; it goes through two carding machines and a condenser, a machine for gathering the wool in one thick lap or silver and passing it out into thirty or forty ribbons one-eighth inch in diameter, which are wound on rollers and taken to a spinning mule.

After spinning, the yarn is woven into cloth which is finished by washing, fulling, burring, cutting and pressing. The woolen yarn is not so firm as worsted. Formerly only long coarse wools were used for worsted, but now short wool is used. Long combed wool is being straightened in every process after it leaves the dryer. Before combing it passes through a number of gill boxes which tend to straighten and lay the fibers parallel. Then it is combed to separate top wool from noil; then drawn and doubled and finally twisted, when the true spinning begins. Short wools must be carded and then straightened by combing and drawing. From this sketch of the processes, you can see the difference in the fundamental steps and can realize why worsteds as a class stand harder wear than woolens. By pulling the threads from a piece of goods you can tell the difference between these two classes.

Heavy cloth made from shoddy mixed with either cotton or wool and then felted, that is shrunken in manufacture, may wear, but it pulls out of shape and often wears "threadbare" showing its true worth. In choosing goods for a dress or other use we should always choose with reference to the purpose for which it is intended.

Class in Horticulture—Universalist Church.

Director H. A. Aldrich, Neoga, Superintendent of Class.

Prof. Jno. W. Lloyd, University of Illinois, Instructor for Tuesday Morning.

The Vegetable Garden.

The garden upon a farm may be a source of annoyance or of pleasure and profit, depending upon the way it is managed. Poor gardens are usually the result of poorly directed efforts and may be more bother than they are worth. Good gardens don't just happen to be good; they result from well-directed efforts.

Much time can be saved in the spring if the garden is carefully planned during the winter. The size, shape and general arrangement of the garden should first be determined. Most farmers' gardens are too small. Land is cheap and labor high. The garden should be large enough to be plowed and harrowed, instead of spaded and raked; and the vegetables should be planted in long rows far enough apart to be cultivated with a horse. If the early planted vegetables are together at one side of the garden, the part reserved for later crops may be harrowed at frequent intervals until needed for planting. This treatment will retain the moisture and keep the weeds from starting.

The plans should include a list of the varieties to be planted, together with an indication of the exact amount of space allotted to each variety, and the time and place each is to be planted. In the selection of varieties it is better to choose those that are known to succeed well in the locality under consideration, or those that are recognized as standard sorts because of their adaptability to a wide range of conditions, rather than new and untried sorts. Usually both early and late varieties of the same vegetable should be planted so as to lengthen the season of its use. It is usually more satisfactory to select seeds from the catalogue of a reliable seedsman and to order by mail, than to depend upon the limited assortment contained in a commission box at the corner grocery.

Most vegetables require rich soil. An application of forty tons of manure per acre is none too much. If this can be applied in the fall and plowed under, the land can ordinarily be fitted for the early planting by simply discing, harrowing and planking. If the soil is in the right condition for working, these three tools will make the seed bed fine and smooth enough for even small seeds like carrots and parsley. This manner of making the seed bed saves much time over the old method of raking by hand.

The whole garden should not be planted in one day, because the temperature requirements of the various crops are quite different. Some crops, like radishes, lettuce and peas, grow best in the cool weather of spring, and are uninjured by frost; while others, like melons, tomatoes and beans, require a much higher temperature and are easily killed by frost. Successive plantings of the same variety of corn, or peas, or radishes, may be made if that method of lengthening the season is adopted.

Thorough tillage is essential to the production of a good crop of almost any vegetable. If a wheel hoe is run close to the rows as soon as the plants appear above ground, and this treatment is repeated at frequent intervals. the labor of hand-weeding will be greatly reduced. The later tilling should be done mainly with a one-horse cultivator. Very little hand-hoeing is necessary in a well-managed farmer's garden.

The insects most likely to cause trouble in the garden are the striped cucumber beetle, Colorado potato beetle and various flea beetles. All these can be controlled by the timely use of Bordeaux mixture and Paris green. Cabbage worms can usually be held in check by spraying with white hellebore, or dusting with air-slaked lime.

Prof. John W. Lloyd, University of Illinois, Instructor for Wednesday Morning.

SMALL FRUITS.

The term small fruit is applied to those fruits which grow upon bushes or low herbaceous plants as distinguished from those which grow upon trees or climbing vines. The principal small fruits cultivated in this State are strawberries, raspberries, blackberries, currants and gooseberries.

These fruits come into bearing so soon after planting, can be grown in so small a space, respond so readily to good care, and furnish such an abundance of healthful food that they should be grown by every farmer who values the health and happiness of his family. Their production for local market is profitable in proportion to the skill of the grower and his facilities for marketing the crop to advantage.

The length of time a small fruit plantation will last depends upon the species and its care. A strawberry patch is the shortest lived. It is ordinarily plowed up after maturing its second crop, though it may be left for a third crop if the plants are strong and the weeds not abundant. Raspberries and blackberries last from five to ten years, depending upon the cultivating and fertilizing they receive, and also upon the presence or absence of the anthracnose or other plant diseases. Currants and gooseberries may last for twenty years or more if properly cared for.

Strawberries are perhaps the most attractive of the small fruits because they reach bearing age the quickest, ripen the earliest in spring, grow to the largest size and respond in the most surprising manner to extra care. Rich soil, plenty of moisture, thorough tillage, restriction of runners, and proper mulching are the essentials of strawberry culture. Whether strawberries should be grown in hills, hedge rows or matted rows depends primarily upon the personal tastes of the cultivator. The largest fruits can be produced in hills or hedge rows, but the matted row often yields the largest crop. The chief objection to the matted row is that the berries are likely to be small, especially toward the end of the season if the weather is dry. The weeds also are more difficult to control in the matted row.

No matter what system of culture is adopted, all blossoms must be cut from the plants the first year; for the newly set plants have not sufficient strength to produce fruit and at the same time make a good strong growth. Any fruit that might be produced the first year would be at the expense of the regular crop the following year.

The disposition of the runners will depend upon the system of culture adopted. In the hill system, all runners are cut off as fast as they appear, and the original plant alone bears the fruit. In the hedge row system, a few runners are allowed to make plants, and these are layered directly in line with the original plants, thus making a continuous row of plants about six or seven inches apart. All other runners are cut off. In the matted row system, the runners are allowed to grow at will until they have formed a mass of plants from one to two feet wide; then all runners extending beyond this line are cut off. It is sometimes necessary to thin out the plants, but usually this is not done.

Whatever the system of culture, thorough tillage should be practiced thoroughout the whole season, and upon the approach of winter, the bed should be mulched with straw or swamp hay, to prevent the heaving of the plants by frost. In the spring, about the time oats are sown, this mulch should be partially removed from directly over the rows so that the plants may grow up through it, but should be left heavy in the "middles" so as to retain moisture. The presence of mulch close about the plants will keep the berries clean.

Immediately after the close of the picking season, the strawberry patch should be mowed and burned over. If grown according to the matted row system, the rows should be harrowed down to six inches at this time, so that new plants may form. Cultivation should be started immediately after burning over, and continued till the close of the season.

Raspberries and blackberries require cultivation the same as do corn and potatoes. This cultivation should be commenced early each spring and continued until after the crop is harvested. Another important factor in the production of these fruits is pruning. This consists of four distinct operations: First, the restriction of the number of growing shoots. Second, the nipping of the tips of these shoots to make them throw out strong laterals. Third, the heading back of these laterals the next spring. Fourth, the removal of the old canes after fruiting.

Currants and gooseberries, also require cultivation, and respond readily to heavy applications of manure. The pruning of these plants consists in the removal of the oldest canes each spring, and of all the new shoots from the crown except those required to replace the old canes. New growths on the canes that are left are thinned out or headed back as much as necessary to balance the bush and allow all parts sufficient light and food to properly develop their fruit. A properly pruned bush will consist of six or eight canes ranging in age from one to four years. These canes will be stout and capable of holding up a crop of fruit, because of proper heading-in while they were young. The proper height for heading in a one year old shoot that is to be left to form a cane is from sixteen to twenty inches.

Professor A. C. Beal, University of Illinois, Instructor for Thursday Morning:

FLORICULTURE.

Floriculture may be defined as the growing of plants for ornament. It is co-ordinate with pomology, olericulture, and landscape horticulture, but with respect to the number of plants, the culture of which is embraced under the term "floriculture," it surpasses the other three combined. Taking the world at large, floriculture is the most important branch of horticulture and in Illinois, considered upon a purely commercial basis, floriculture equals pomology in the value of its outpnt if we consider one year with another.

We may divide the subject into indoor and outdoor floriculture. Each of these may be subdivided into:

1. Growing flowers for profit, or commercial floriculture.
2. Growing flowers for pleasure, or amateur floriculture.

The growing of flowers for pleasure is the topic on which I wish to speak because it is the only branch of horticulture possible for all classes of people rich or poor, whether they live in town or country, palace or tenement. We would naturally consider window gardening first, but as I treated the topic last year, I believe we would better turn our attention to other phases of the subject.

USED IN MASSES.

The most important use of outdoor flowers is their effect when used in masses or as elements in a landscape picture. Flowers may be grown in beds or borders. The flower bed should never be placed in the front lawn because the plants are seldom as effective as when seen against a background. Furthermore, the effects, such as they are, are transitory, in that what may be a good group of plants for four months is simply a spot of bare ground the remainder of the year. Many people think of the flower bed as a carpet bed of more or less intricate design. It is best to leave these to the skilled gardener who has the experience and the facilities for maintaining such beds in good condition. Carpet bedding has its place, but a poorly executed piece of work is a most lamentable thing.

If one wishes to plant in beds make them long in proportion to their width, so they do not look like mere play at gardening.

VALUE OF PERENNIALS.

For the farmer the most satisfactory method of securing the beautiful color effects with flowers is to use perennial plants in an informal border along the boundaries of a place in front of shrubbery or fences. It is best because it is simpler, easier to plant and usually its pictorial effect is greater than the flower bed, since it is not so likely to appear formal or out of place. I recommend perennials because they are permanent, easy of culture, and beautiful, not only in flower, but in form and foliage.

The most reliable perennials are paeonies, iris, phloxes, candytuft, gaillardia, larkspur, cardinal flower, asters, sunflower, golden marguerite, golden rod, fox glove, sweet william, pinks.

There is also that great class known as bulbous plants. If there is any class of plants preferable to grow in beds it is the bulbs. Another class of plants are the climbers. These are useful for screens, and for softening lines in the design. Many are perennial, others are annual. Some are adapted for clinging to walls, others are twiners, and still others require support.

Annual flowers have an important place in supplementing the display in the informal border, so that the border may be full at all times. They have an added value to the tenant who does not wish to plant the more permanent flowers.

In selecting kinds, great care should be exercised to get those which are reliable.

BOLD MASS DISPLAYS.

For bold mass displays at the rear of the grounds or borders, such plants as sunflower, castor bean, striped Japanese corn, spider plant, zinnias, African marigolds and nicotinas are suitable.

For lower growing masses, California poppies, sweet sultan, calendula, coreopsis, calliopsis, gaillardias, China asters, larkspurs. For still lower growing color masses, use sweet alyssum, candytuft, phlox, ageratum and verbena.

If the annuals are wanted early, the seeds must be sown in boxes in the house, or in hotbeds or frames. It is better to depend upon the perennials and bulbs for early bloom. A few annuals like the moonflower and tall cosmos must be started early, because they require a long season. A few do not easily transplant, and must be sown where they are to stand; i. e., larkspur, poppies, California poppies, argemone, hunnemania, and nigelia.

The flower garden is an area set apart for the growing of flowers. It is the expression of an interest in plants for their own sake. The garden should be located in the rear of the dwelling so that it does not intrude upon the general planting.

Here may be grown all those pretty and interesting plants unsuited to mass displays as well as the untried ones.

CLASS IN LIVE STOCK—CASTLE HALL.

EDWARD GRIMES.

Director Edward Grimes, Raymond, Superintendent of Class.
Prof. Wm. Dietrich, University of Illinois, Instructor for Tuesday Morning.

LIVE STOCK.

The live stock class at Castle hall was called to order by Superintendent Grimes at 9:15. There were about twenty-five men present. Instructor Wm. Dietrich, of the State University, discussed the raising and feeding of swine in general, but principally of brood sows.

Among the recommendations were to keep the good brood sow as long as she will breed. The best feed recommended was a mixture of charcoal, wood ashes, bran and saltpetre as an appetizer; also to have the hog matured for market at nine months of age, and to weigh 280 to 300 pounds.

Prof. L. D. Hall, University of Illinois, Instructor for Wednesday Morning.

MEATS—LIVE STOCK CLASS.

There was general disappointment at Castle hall this morning when Superintendent Grimes called the crowd to order and said that Mr. Obrecht, who was expected to talk on horses was sick in bed with the grip, and introduced Prof. Louis D. Hall. instructor in animal husbandry of the State university, who would talk on "Meats."

The professor who is very youthful in appearance, got right down to business with the statement that about one-fifth of our meat was bone, three-fifths water, with a little allusion to the 9 per cent of water in pure milk, to say nothing of that in the other kind. Also about one-third of all the money expended for food went for meat, and among the substitutes for meat quoted baked beans as being fully equal to meat rations for sustaining life and of an experiment at the university in which a number of the student lived on roatsed peanuts and rice. He did not see but that they looked and recited as well as any of the rest. A number of charts were used showing the different parts and cuts of beef, mutton and pork. In answer to the question as to how many could tell exactly where to cut out porterhouse and sirloin steaks, nine hands went up out of about thirty-five present.

Professor Hall remarked that out of fifty students, only two responded and one of them could not "show up" correctly. Young meat has a larger proportion of bone than older animals. Meat from females is usually more tender and juicy than from males, but the steer brings the higher price owing to the usual sexual condition. Meat should be well ripened but meat from lean animals will rot before it will ripen. Good meat is better three weeks after killing than three days after, provided it has been kept frozen, but it must be used right away after it is thawed out.

Prof. H. W. Mumford, University of Illinois, Instructor for Thursday Morning.

CATTLE FEEDING.

One weakness in ordinary investigations and the conclusions drawn from them, is that too few animals are experimented with. Often there are only two, three or four in a lot. At the Illinois station there is a car load in each lot, and the results are not a question of individual differences of cattle, but of the difference of rations.

Can we afford, with corn at 40 cents per bushel, to feed oil meal, gluten meal, or cotton seed meal?

THE ROUGHAGE.

In such experiments too frequently nothing is said about the kind of roughage. It makes a difference whether we feed timothy or clover hay. One of the first experiments worked out in cattle feeding at the Illinois station showed that corn and clover hay produced gains 1½ cents per pound cheaper than corn and timothy hay. Thus it was found that a bushel of corn fed with clover is worth 5 cents more than when fed with timothy. The reason is that corn and timothy are too much alike in composition. The cattle need along with corn something to balance it up. If timothy is fed oil meal or cottonseed meal is needed to balance the ration. The speaker would as soon have good corn stover as timothy hay. Their comparative value has been fairly accurately determined.

In this experiment clover hay was fed to all lots. This should be distinctly understood. If clover had not been fed there is no question that it would have paid to feed oil meal or some such feed. Wherever it is stated that both gluten meal and oil meal were fed it should be understood that gluten meal was fed the first half of the feeding period and oil meal the last half. The cattle were all of the same grade, choice feeders, and approximated 1,000 pounds when put on feed. These calculations are on the basis of 35 cents per bushel for corn, $8.00 per ton for clover hay and $5.00 per 100 pounds for pork.

THE RATIONS FED.

The rations and methods of feeding for the different lots are as follows:

1. Silage, corn meal, gluten meal, oil meal and clover hay.
2. Ear corn, gluten meal, oil meal and clover hay.
3. Ear corn and clover hay.
4. Corn meal, gluten meal, oil meal and clover hay.
5. Corn meal, gluten meal, oil meal and clover hay, the hay chaffed and mingled with the grain.
6. Corn and cob meal, gluten meal, oil meal and clover hay.
7. Corn and cob meal, gluten meal, oil meal and clover hay. The hay chaffed and mingled with the grain.
8. Shock corn, ear corn, etc., (according to common practice), and clover hay, oil meal being fed the latter part of feeding period.
9. Shelled corn, gluten meal, oil meal and clover hay (fed in ordinary dirt or mud lot).

10. Shelled corn, gluten meal, oil meal and clover hay (fed in paved lot in comparison with lot 9).

OIL MEAL GIVES QUICKER FINISH.

The rations containing oil meal or gluten meal will produce a finished condition in a shorter time than the corn rations, and on the market the cattle which had been fed oil meal brought 20 cents more per 100 pounds than the corn fed cattle. Cottonseed meal will also produce the quicker finish.

THE CATTLE FEEDERS' STANDPOINT.

In what form shall we feed corn to the best advantage? The study of this subject was taken up from the cattle feeders' standpoint—that of the net profit, not merely of how much gain in beef. There is more to be considered than the amount of gain made, viz.: the cost of that gain. The final question to the practical cattleman is, what is the net profit on the whole transaction?

A QUESTION TO SETTLE BY TEST.

The longer you feed oil meal the higher the finish, but you can see the effects of it in sixty days. The question was raised whether if oil meal is to be fed just sixty days it should be fed the first sixty days or the last sixty days of the feeding period. Professor Mumford said, "I don't know." He said that most persons would answer the last sixty days, that being the common practice. But he has seen such a difference in the way cattle start on feed. It takes a great deal longer to get cattle started to gain on corn and clover hay than where oil meal is fed at the first; with oil meal they start right off. The corn and clover cattle make their large gains along toward the last. He would like to see the matter tested scientifically. The oil meal will show in the finish of the cattle if it is fed at the beginning as well as at the close of the feeding period.

In lot 8 below the oil meal was fed only during the last sixty days; in all the other lots where it is named in the ration it (or gluten meal) was fed all the time. Corn will produce the finish on cattle if it is fed long enough. In the comparisons here given the actual cost of everything is counted. When ground feed was used the cost of grinding was reckoned in. An exact account was kept. The exact cost of the silage is figured.

These cattle were fed six months, and the first column in the table shows the average daily gain per steer for six months. "Chaffed" hay here means hay run through the ensilage machine and cut up.

THE GAINS AND THEIR COST.

LOT NO.	Average daily gain—pounds	Net cost per pound of gain	Pounds pork produced per steer....	Pounds pork and beef produced per steer ....
1	2.34	$0.076	6.30	442.14
2	2.33	.067	62.60	496.30
3	2.08	.059	74.13	460.40
4	2.38	.075	20.66	463.32
5	2.33	.079	20.02	454.16
6	2.32	.078	18.00	450.03
7	2.45	.076	24.00	479.94
8	2.08	.065	73.50	461.00
9	2.02	.077	85.80	460.97
10	1.99	.075	111.50	482.17

OIL MEAL MAKES CATTLE EAT MORE.

The average daily gain for six months was 2.08 pounds for the cattle fed on corn and clover hay (lot 3). This is not as great as with the lots fed oil meal. This is explained when it is noted that the cattle did not eat as much grain with corn alone as with corn and oil meal. The lots that had oil meal ate nearly as much corn as the others, and the oil meal besides. The average daily grain ration when the cattle were fed oil meal was 23.8 pounds, while several other lots ate close around 20 pounds.

TOOK MORE CORN TO MAKE SAME GAIN.

In lot 3, fed on ear corn and clover hay, it took 10.17 pounds of grain to produce a pound of gain, while in lots 1, 2, 4 and 5, where oil meal was used, it only required 8.39, 9.86, 8.21 and 8.42 pounds of grain respectively to produce a pound of gain. It required more pounds of grain to make a pound of gain when oil meal was not fed. The nitrogenous feeds do add to the efficiency of corn.

It took more roughage with shelled corn than when corn and cob meal was used; the cobs ground up do save roughage.

PIGS GET LOTS OF THE SHELLED CORN.

Comparing the figures for lots 9 and 10 in the second and fourth columns with the other figures in the same respective colums, it is seen that the steer gets less out of shelled corn, and the pigs following get more, than out of any other ration. The pigs with the cattle fed shelled corn made 85.80 and 111.50 pounds of pork per steer, the highest figures in the column, while the pigs following the silage fed steers got very little to eat, making only 6.30 pounds of pork per steer. The hogs were fed no extra corn, and just enough hogs were put with each lot of cattle to consume the waste and make good gains.

BUT CORN MAKES CHEAPER BEEF.

But the steers fed on corn alone (lot 3) made beef at a cost of .059 cents per pound, but in the other lots the cost was close around 8 cents. And this introduces another chapter of results.

THE NET PROFIT.

Lot Number.	Margin per cwt. required.	Market value per cwt.	Net profit per-steer—25c corn.
1	$1 22	$6 10	$ 6 57
2	1 15	6 15	12 07
3	97	5 95	12 12
4	1 27	6 15	8 45
5	1 38	6 15	6 97
6	1 33	6 10	6 61
7	1 30	6 15	8 05
8	1 08	6 05	11 46
9	1 43	5 95	6 64
10	1 53	6 05	7 95

WHAT THE TABLE SHOWS.

The second column of figures above represents the margin between buying and selling price required to come out even. It is seen that the cattle fed corn alone (lot 3) require a smaller margin than any of the other lots—only $1.17.

But the oil meal fed cattle have the higher finish and higher market value, as told in the third column.

NO ADVANTAGE IN EITHER METHOD.

But the outcome of this investigation all centers in the last column, which shows the net profit. There is so little difference between the corn fed and the oil meal fed lots that no advantage can be claimed for either as to profit. The old method of feeding corn alone here shows just as much profit as from the use of oil meal—not as much gain, not as good finish, not as high a price in the market, but just as much money for the cattleman. But all these cattle had the advantage of clover hay, a nitrogenous feed. But for this there would have been greater profit in the lots fed oil meal than in the lots fed corn alone. To summarize, then, it may be said that for

RAPID GAINS AND QUICK FINISH

1. The average daily gain per steer in pounds in the various lots is as follows: Lot 1, 2.34; lot 2, 2.33; lot 3, 2.08; lot 4, 2.38; lot 5, 2.23; lot 6, 2.32; lot 7, 2.45; lot 8, 2.08; lot 9, 2.02; and lot 10, 1.99 pounds.
2. Silage ranks with ear corn, corn meal, and corn and cob meal in its ability to make rapid gains on fattening cattle.
3. Corn meal and corn and cob meal seem to be about equally efficient in producing quick finish.
4. In this test more rapid gains were secured with whole than with shelled corn, and equally as good as with meal.
5. A reasonably quick finish may be secured without the feeding of an excessively heavy grain ration. In this test the largest average amount of concentrates fed daily throughout the experiment was in lots 2, 6, 7 and 8, in all of which the cob is included. The daily ration of concentrates in these lots varied from .23 to 23.5 pounds, or approximately one peck of ear corn and three pounds of gluten meal or oil meal per thousand pounds live weight of cattle.
6. The feeding of a nitrogenous concentrate to supplement corn undoubtedly stimulates the appetite and increases the capacity of the steer for consuming to advantage large quantities of concentrates. Hence this system of feeding is to be recommended where a quick finish is desired.

ECONOMICAL GAINS—EFFICIENCY OF FEEDS.

7. Where conditions are such as prevailed in this experiment, corn and cob meal is not so valuable for fattening steers, pound for pound, as corn meal.
8. The presence of the cob in ground corn does not appear to materially increase the efficiency of corn for beef production, or for combined beef and pork production, under conditions prevailing in this test. Whether or not the cattle feeder should use corn meal or corn and cob meal is largely a matter of convenience, what roughage is used, how the corn part or the ration is supplemented with other concentrates, and perhaps the season during which it is used.
9. A given amount of corn and cob meal did not produce any more beef, and considerably less beef and pork combined, than did ear corn.
10. Corn meal proved much more efficient for beef production than shelled corn, while for combined beef and pork production, they appear to be about equally efficient.
11. Corn meal is not more efficient for beef production than is ear corn.
12. Ear corn is much more efficient for beef production than is shelled corn.
13. This test indicates that the supplementing of corn with nitrogenous concentrates used in this instance increases the efficiency of corn and clover hay for beef production.

14. The chaffing of hay and mingling it with the concentrates in the form of meals, did not add materially to their efficiency for beef production, although by this system of feeding there is less likelihood of getting the steers off feed or of scouring.

15. By following the method employed in this test of getting cattle on full feed, large and economical gains may be secured up to the time of marketing without the length of the finishing period being materially lengthened. That is to say, as large and as cheap gains are made during the last as the first half of the feeding period.

PORK MADE.

16. The amount of gain made by hogs following steers appears to be largely regulated by the amount of undigested corn in the droppings of the steers in an available form for the hogs to recover; therefore, larger gains are made by hogs following steers fed corn only than where it is supplemented with oil meal and gluten meal thus rendering it more efficient for beef production.

17. Where enough pigs are provided to consume undigested feed in the droppings of steers it requires fully twice as many where corn is fed whole as it does where meal is fed to the steers.

18. The gain on hogs following the different lots of steers per steer in pounds was as follows: Lot 1, 6.3; lot 2, 62.6; lot 3, 74.13; lot 4, 20.66; lot 5, 20.02; lot 6, 18.00; lot 7, 24.00; lot 8, 73.5; lot 9, 85.8 and lot 10, 111.5 pounds. The pounds gain made by the hogs per 100 pounds corn fed the steers was as follows: Lot 1, .19; lot 2, 1.68; lot 3, 1.89; lot 4, .67; lot 5, .65; lot 6, .46; lot 7, .63; lot 8, 1.81; lot 9, 2.79; lot 10, 3.61.

PROFITABLE GAINS—MISCELLANEOUS.

19. For profit to the cattle feeder the three rations giving best returns ranked as follows: Ear corn supplemented with oil meal and gluten meal; shock or fodder corn and ear corn; and ear corn without supplement, clover hay being fed in all the lots. The profits in these lots, 2, 3 and 8 were so nearly alike that the conclusion that the feeding of any one of these rations would be followed by larger profits than the feeding of the others would be unwarranted.

20. The three rations giving smallest net profits were shelled corn (mud lot), corn and cob meal, corn meal (hay chaffed). In each of these instances the corn part of the ration was supplemented with oil meal and gluten meal.

21. The cost per pound of gain on the steers varied with the different methods of feeding from 5.9 to 7.9 cents per pound.

22. There was a difference of 20 cents per hundred weight in the marketable finish of the various lots.

23. The net profit varied from $4.13 to $9.84 per steer.

24. From the records of this experiment, $0.26 per hundred weight should be added to the cost of feeders in market to determine their cost delivered in feed lots where freight rates and shrinkage in shipping are comparable with conditions obtaining in this test.

25. The method of feeding steers may make as much as $0.50 per hundred weight difference in the margin necessary for coming out even. The methods involving least labor requiring a margin of approximately $1.00 per hundred weight for choice steers, while those requiring a maximum amount of labor require a margin of about $1.50 per hundred weight. Steers fed by the former method are not as a rule in a desirable marketable condition as those fed by more complex methods, hence, the latter usually command a higher price on the market; in this instance the difference was but $0.20 per hundred weight.

26. The results of this experiment are so striking that it appears that the grinding of corn for feeding choice two year old steers during the winter season is not warranted. The profits of feeding ear corn are fully twice as large as those secured in feeding corn meal or corn and cob meal.

27. The feeding of silage in moderate quantities is not necessarily conducive to heavy shrinkage in shipping or small percentages of dressed beef. The reader is cautioned not to conclude that since the feeding of silage was not followed with as large profits as the feeding of several other rations, that it has no place in beef production. Its use in growing young cattle and as a part of the ration of the breeding herd promises well in the hands of the experienced feeder, but to just what extent it may be profitably used for these purposes remains to be determined by future investigations.

28. Many who advocate the feeding of ear corn to cattle if hogs follow, advocate the feeding of meal if for any reason it seems desirable to eliminate the hog. The results of this experiment do not warrant such a conclusion. After eliminating the hog from the cattle feeding operations here presented the feeding of broken ear corn was followed with larger profits than the feeding of meal.

29. Since the profits in feeding shock or fodder corn and ear corn are approximately the same the writer is inclined to favor the feeding of ear corn in preference to fodder corn because in feeding fodder corn one is sometimes obliged to get on the land when it is too wet. This statement applies especially to seasons of the year when bad weather is likely to prevail.

30. While the results of this experiment show that it does not pay to grind corn for winter feeding it should not be assumed that it does not pay to grind corn for cattle that are being fattened in summer on grass.

Class in Poultry—Woodman Hall.

E. N. COBB.

Director E. N. Cobb, Monmouth, Superintendent of Class.
Mr. T. E. Orr, Beaver, Pa., Instructor.

[From the Joliet News.]

Prof. T. E. Orr started the poultry class a little late on the first day, and a large crowd came from the theater building that filled up Woodman hall nicely. Professor Orr said he regretted that he could not make his talk in the morning, but still he did not know but that it was as well, as it was likely there was a larger gathering out.

He was glad to see that the farmers' institutes were taking up the subject of poultry, for it has only been the last year or two there has been any talk about it at their meetings. He said he would have to rehash a great deal of what he said at the State Farmers' Institute last year at Decatur. It was like all other subjects treated at farmers' institutes. The grub worm, cut worm, rust, fertilizers, rotation of crops were on the program repeatedly, and he did not know why he should not try to follow on the same lines that he did at the meeting last year.

He found different states were taking up poultry in their experimental work, and he mentioned three or four states that were very prominent in their experimental work, carrying it through the year. Cornell University, New York, had taken up poultry culture carried on experimentally. The students would have the whole care of a pen of chickens experimenting on feed, housing, etc. As soon as it was announced that they would have a class in poultry culture, the applicants came from different states. They had really more applicants than they could take care of, showing that the interest in poultry is growing as it should. In the past the hen has received very little attention, being considered but a by-product of the farm.

The three leading states in poultry are Illinois, Iowa and Missouri, In Illinois the proceeds is about $10,000,000 for eggs and $10,000,000 for poultry, In Missouri, at a later census, the proceeds were $24,000,000.

Professor Orr's subject was blood. He called the attention of the audience to how blooded horses were produced, blooded cattle and especially the Holstein cow. Back east years ago they had a cow they called the Pennyroyal breed, She seemed to be a native, and could stand the winters and go a long time without food. When she had a chance to fill up her capacity was such that she was capable of filling up so as to last her many days. If she got into a cabbage patch she would completely ruin it. Her digestion was very slow. The Jersey cow was bred to consume large quantities of food and to digest quickly, and that food went to produce butter, until the Jersey cow could consume twelve times her weight in a year. On the same lines poultry has been bred till the hen can consume seventeen times her weight in food, and this goes to produce eggs.

He warned the farmers particularly to be careful of buying new blood, and cross-breeding. One year they would buy a White Plymouth Rock; another year they would buy a Langshan; another year that chicken got too leggy and big for them, and they would try a Wyandotte, and when they did get settled down to raise full bloods of that stock, the full blooded stock they had already used of different varieties would crop out and give them all kinds of trouble. It was better for them to start with old fashioned fowls that had no particular blood. Not having any full blood that stock would respond to the breeding sooner.

No matter what kind of fowl or what variety was wanted, get the kind you like the best and adapted for your market. When you start in with any particular strain of that variety, follow on that line, and breed what is called "line breeding." That is, if a male was bought, and that male proved to be a good bird, and the party it was bought of proved to be an honest man, Professor Orr advised that they buy their males as they wanted them from that man so as to use his experience in bringing up their fowls to a high standard. Unless a person was very careful and knew what he was doing, he had better not undertake to inbreed his own chickens.

Professor Orr had followed the system of line breeding for twenty years on one strain of fowls, and the results were most gratifying. The chickens retained their health, and he felt confident that he had accomplished what he started out to do. On the other hand if he had used top mating from different strains of the same variety, he could not have told what quality he would breed.

The proceeds are about $60.00 per capita to the farmers of Illinois, and by judicious breeding, full bloods, he had no doubt, could produce fully as much with half the number of fowls.

Professor Orr said the people around here were very fortunate. They had a great advantage over eastern people in producing eggs and meat. The feed was so much cheaper. They could raise their own feed, while he was forced, back in New York, to buy his feed at high prices, and then it was cheaper than he could raise it on the poor land. Then we were so situated near the Chicago market that our market was equal, if not better, than the New York market taking into consideration the cost of grain and cost of feed.

He did not see why a farmer could not raise fancy stock and sell at a less price than a person living in the cities or villages. He had open range, and could raise all his feed.

Quite a number of persons asked questions about line breeding or in-breeding as some call it. The definition of line breeding is breeding fowls in a systematic manner, and in-breeding would be using the same blood for top mating without any special way of doing it, or object.

POULTRY JUDGING.

Woodman hall was crowded to its capacity in the afternoon with poultry men who came to hear Mr. Orr lecture on the judging of fowls. He explained the difference between the score card method and comparison. He had no preference for either, but said that the score card was more beneficial to the beginner or the man who could not attend the show. After looking over the birds on exhibition, he complimented the owners on the quality of the stock, some of the birds being the best of their kind he had ever seen. The meeting adjourned at 2:00 p. m., but Mr. Orr kindly remained in the hall for another hour answering the various questions of his listeners.

[From the Joliet Republican.]

TALKS ON FARM POULTRY.

"The hen is a manufacturer who converts our raw material of the farm into a salable commodity," said T. E. Orr, of Beaver, Pa., in his talk before the poultry class, which met in Woodman hall this morning. Continuing from this standpoint, he said he desired to talk mainly to farmers, as he had no doubt but what the best poultry was raised in the country, notwithstanding the fact that large cities contained many ardent chicken fanciers, who produced fine poultry.

"Until we keep a strict account of the hen in a business-like way, we can never know its real value and our estimates are mere guesswork. Therefor I would suggest that some member of the farmer's family be given complete charge of the poultry and keep exact account of its cost of living and the money derived from its produce."

Mr. Orr, owing to train troubles, failed to arrive in time to conduct the yesterday morning class, but a special meeting was later planned for the afternoon and was held in Woodman hall from 4:00 to 5:00.

The poultry classes are well attended and by some of the most enthusiastic chicken fanciers of the state, the ladies being among the most interested listeners.

FOODS.

A large, enthusiastic crowd attended the class this morning. Mr. Orr was on hand promptly at 9:00 o'clock. He said that the hen was the machine that converted the raw products into a marketable condition, and in order to ascertain whether she pays her board or not, we must keep an accurate account of all transactions.

He advocated corn as a good feed for growing chicks but did not place much value on it as a food for adult fowls. Ground oats and either sweet or soured milk (never use milk in a souring condition) was what he thought the best food to develope chickens.

To balance fatty foods, especially corn, place a box of dry bran where the fowls can have access to it.

He recommend the occasional use of a wet food but not in a sloppy condition.

Green food such as alfalfa or clover are necessary to egg production.

Oyster shell and some sort of grit (mica crystal grit the best) should be used. Beef scraps as sent out by the packing houses should be fed during the winter to make up for the bugs and worms picked up by the fowls during the summer.

The chicks should receive their first food after thirty-six hours; then to be given grains. The chick food as sold on the market was recommended. The birds on exhibition were judged between 1:00 and 2:00 o'clock this afternoon.

CLASS IN SOILS—OPERA HOUSE.

Director Ralph Allen, Delavan, Superintendent of Class.
Dr. Cyril G. Hopkins, University of Illinois, Instructor.

RALPH ALLEN.

TUESDAY MORNING.

(From the Joliet News.)

When Supt. Allen of the class on soils introduced Dr Hopkins, the instructor of that class this morning there were about seventy-five people present, mostly interested farmers, and there were nearly double that number before the hour was over.

Dr. Hopkins said a general or preliminary survey of the soils of the state had already been made in which as nearly as possible the boundary lines of each type of soil in a locality had been indicated on maps, and analysis of these types had been made.

These maps and analyses will be published in a bulletin which will be issued from the experiment station in a few weeks.

He explained to the class that plant growth was in proportion to the amount of leaf surface.

Upon being questioned why so large an amount of the essential, elements, nitrogen, phosphorus and potash were necessary he explained that it was only under very high cultivation that it was possible for a plant to liberate and utilize over one per cent of these elements.

While he entered somewhat into the technicalities of the subject it was only to explain how cultivation and its results on the bacteria of the soils aided plant growth by admitting oxygen into the soil.

At the close of the hour he distributed circular No. 68 of the Illinois experiment station with the request that the class read the first ten pages as preparation for the subject of tomorrow morning's session which will be devoted to "Farm Manure and Rotation of Crops."

WEDNESDAY MORNING.

At 9:00 a. m., Wednesday, Feb. 22, 1905, at the Joliet opera house, Superintendent Ralph Allen, chairman of the class in soils, in introducing the instructor, said: The doctor begins this morning where he left off yesterday. I suppose most of you have read the ten pages he told you to read in his bulletin, and then we will take up the subject of manures and leguminous crops.

C. G. Hopkins, professor of Agronomy, University of Illinois, Urbana, Ill.:

I believe that the study of plant-food is really less understood than almost any other factor essential to crop production. Of course we have many other essential factors in the growing of crops. It is absolutely essential that we have the seed, and good seed, because without good seed we cannot expect good crops on any soil; and we count that one of the essential factors in growing crops is good seed. Then, we must have the soil in good physical condition. By that, I mean the home of the plant. We must have a good home for the plant; that is, independent of the plant-food. We must have a soil where the roots can run in it freely, particularly the corn-roots, because corn needs a loose, porous soil, where the roots can run freely. We must have moisture, and heat, and light. Without any of these things we cannot grow crops. They are all absolutely essential factors. But of course the factor light probably never limits the yield of crops, because we have so much light. We may have light enough to make 300 bushels of corn to the acre, if we had the other factors in equal abundance or perfection. And we have heat enough, I suppose, for 200 or 300 bushels, as a rule.

We can do something to change the heat in the soil; not a great deal, maybe, but we can do something. In the spring of the year we can have the soil well drained so that the surplus water runs out through the drains. If we do not have good drainage, and our land stands full of water, then the heat that comes from the sun is used up in evaporating the water from the surface, and that keeps the land cold. And so we commonly speak of wet land as cold land. It is cold because it is wet, and because the heat that ought to warm it is used up in evaporating the water from the surface of the soil.

I do not know whether you are familiar with the amount of heat required for different purposes, but we have ways of measuring heat. The heat units are called calories, and some of you will remember back, in your physics work, the amount of heat that is required for different things, and I think it fits in here very nicely. If I remember rightly it takes 80 calories or 80 heat units to melt ice, to change water from the solid form to the liquid form. It takes 100 units to raise the water from the zero point, after it first melts to

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NOTE.—Circular No. 68, referred to above may be found in full in Farmers' Institute Report, Vol. VIII., pp. 119-144.

the boiling point. Now, if I am not mistaken, it takes 537 calories to evaporate it. So you see the tremendous amount of heat that would be consumed in the evaporation of water from the soil. We commonly think that to melt the ice requires much heat. But that is only a small part, 80 calories. Then, to raise the water from the freezing point to the boiling point only takes 100 calories. And yet to evaporate that water from the surface of the soil takes 537, or more than five times as much as it does to raise it from the freezing point to the boiling point. And that is why we use up the heat, many times, in the spring, by the evaporation of the water from the surface; the surplus water that we have no use for. Plants are injured by it rather than benefited. If we have tile drainage, sufficient for the land and properly laid, and let the water go out, the soil begins to warm up quicker, and you get a warmer soil, so that the seed germinates in it more readily. Thus we can do something towards controlling the heat of the soil.

And we can do quite a good deal toward controlling the moisture, which is another necessary factor to crop production. Thus, we have mentioned light, heat, and moisture; three absolutely essential factors, and then we have the seed and the home of the plant. There are five; and plant-food is the other one. But it is only one in six of the essential factors.

I believe that we appreciate the importance of the other factors more than we do that of plant-food. Now, that is due largely, I suppose to the fact that the plant-food is hidden. We cannot see it. You can put on a heavy application of phosphorus on the soil, but you cannot tell it from the soil's appearance, and you can go and look at one soil which is exceptionally rich perhaps in phosphorus, and then you can look at another that is poor, but you cannot detect the difference. When people look at a peaty swamp soil, they commonly say, this is certainly the richest soil in the world. It is black as soil can be. It is in splendid physical condition, and it holds moisture as well as any soil can, cultivates nicely. and is well drained. You have all the conditions, and yet there is one element of plant-food commonly lacking in that soil. You cannot tell it from the surface. But you get, after a time, perhaps, so that you know that the peaty swamp soils are usually deficient in potassium. But no one would suspect it from looking at the soil. Therefore I think we can well afford to spend a little time upon this subject of plant-food.

You remember I spoke yesterday morning about adopting some sort of a standard as to what a soil ought to be, so that the analysis of it would mean something. We find a soil, for example, that has 500 pounds of phosphorus to the acre in the plowed soil and we find that a corn crop needs only twenty-five pounds. We might think that soil to be rich in phosphorus, but we don't know whether it is or not, until we get a standard for comparison. So, if we can figure out some system by which we can measure the soil, then we have a good deal better idea. You will remember that I suggested measuring the value of the soil, or the richness of it, by assuming that by cultivation and by nutrification we can liberate 2 per cent of the nitrogen of the plowed soil in a year. If so, out of 5,800 pounds, we could hope to get 116 pounds in a normal season. And with the phosphorus and potassium we can hope to get out 1 per cent, very roughly estimated, as a general average. Now we may compare a soil with the normal or standard soil that we have adopted as the average of the German standard soil and the United States fertile soils: the average of those two that have been worked out as nearly as can be determined. We have a black clay loam common in the Wisconsin glaciation. We try to use these names to designate the material. Everyone will agree that it is a loam and that it is black, and then we say clay because that is one of the principal constituents in it that characterizes it. Sometimes we speak of a clay soil that is not truly clay. The common timber soils are not clay soils because the material is chiefly silt. I always think it is better to call things by their right names than to use a wrong name, and then discover years and years afterwards, that not only the people who are studying, but also those who are teaching, are misusing names. It adds confusion. And that is why we say phosphorus instead of saying phosphoric acid; we say potassium instead of potash because it is phosphorus and potassium that we are interested in. We say nitrogen instead of ammonia.

Now the particles of the soil that give it the plastic or sticky qualities are clay. Clay is a very fine material. It is something like dough. You take ordinary wheat flour and mix that up with water and you get dough that is plastic and has no grain to it at all. There are really no individual particles that you can detect in dough and neither is there any in clay. But you rise to the particles next larger than that and we call that silt. Silt is more like fine ground corn meal. You can take corn meal and mix it with water and you do not get dough. It does not become plastic and sticky. You always have little particles in it. And that is the way with silt. You can have silt and clay mixed together and get a somewhat sticky soil. A clayey soil with organic matter gives us a black clay loam and the most characteristic material in it is the clay and that gives it the sticky property. Sometimes it is called gumbo. This soil occupies large areas of land. I have shown the average position of the black clay loam in the Wisconsin glaciation. And I would say that we have a good deal of this black clay loam in the middle Illinois glaciation, and we have some in the upper Illinois glaciation, and there is a little found in the Iowan, but not much. But in the early Wisconsin glaciation there are large areas of it. It is found in all of the land that was what you call heavy swamp land; not the peaty swamp land like that near Kankakee, but the land that was poorly drained where there has been a little surface wash from the good prairie land down into the low places; and we have broad level stretches of land that grew grass as high as a horse's back in the early days and that you could not drive across; that you could not work at all until it was tile drained or big ditches dug through it, and then, when it was worked out it was black, crumbly soil, and when you try to plow it when it is a little wet it is just as sticky as it can be. It is rich in organic matter, but also a heavy soil, sometimes called gumbo. Just notice what that soil is, as compared with the normal standard soil. We think we ought to have 5,800 pounds of the nitrogen, we have 7,980 in the black clay loam. We think we ought to have 2,000 pounds of phosphorus and we have 1,920. It is practically normal in phosphorus and away above normal in the other elements. Without any treatment on that soil we get seventy-five bushels of corn to the acre.

Another soil that will interest most of you is the brown silt loam also of the Wisconsin glaciation. But this type of soil, or a type very closely related to it, is found throughout the corn belt. I might say that the south line of the corn belt is pretty nearly measured by the north line of the old Illinois glaciation. And I think that we have, perhaps for the first time, really established the north line of "Egypt." You know when you get into that country they always tell you that Egypt begins "over in the next county." But I really think that the north line of Egypt is the south line of the Wisconsin glaciation; that is on the north line of Cumberland and Shelby counties. Shelby runs into the Wisconsin glaciation a little bit and the Cumberland just a trifle. Coles county is in the Wisconsin glaciation.

A Delegate—Why is it called Egypt?

Professor Hopkins—It is said that in the early days, when the country up here was newly settled, and much of this land was swampy, and could not be cultivated, the farmers of the north went down there to buy corn, as they did in Bible times; that the countries of the north went down into Egypt to buy corn, to live on and get their seed. And the oldest settlers down there say that is absolutely the fact; that was the reason they called it Egypt; that the farmers in the north spoke of going down to Egypt for corn. Of course there are several other reasons that might be given; one is the capital or chief city down at the southern end of the State is Cairo; and even Alexandria is down there, too; indeed, they have a number of towns that were somewhat related to Egypt. But if you pass from Coles county, where the land is worth $150.00 an acre—as good land as we have in the State anywhere—down into Cumberland and Effingham counties, on the south, you will find that the land is worth $25.00 to $30.00 an acre.

A Delegate—What is the reason that land is worth so little money?

Professor Hopkins—It is worth so little money, because it does not produce large crops.

A Delegate—Will it produce anything?

Professor Hopkins—Yes, sir.

A voice—Politicians. (Laughter.)

Professor Hopkins—Some authority has said that it produces the best men in the world. And it also produces fine apples. And it produces about a half ton of timothy hay to the acre, which is the principal crop.

A Delegate—How about redtop?

Professor Hopkins—It does produce redtop.

A Delegate—How about wheat?

Professor Hopkins—The wheat is all right, when you get the soil in shape for it. It is a splendid wheat soil, so far as the home of the plant is concerned. It is a splendid soil for wheat, but it does not afford sufficient plant food, and it has been run to wheat so long that the elements required to grow wheat have been too largely removed from the soil. One Champaign county farmer, who has been down in that area, said to me that the only thing they need to do is to get some of that yellow out of the land. The people down there mostly call it white clay. It is a light-colored soil, but not clay. We call it gray silt loam. Note the composition of the soil—the gray silt loam of the lower Illinois glaciation. We have 3,150 pounds of nitrogen to the acre, as an average of many analyses, from many different counties. This represents, you remember, the principal type. They have bottom lands that are quite rich, and they have several different kinds of soil but the principal one—the common, level prairie land, is represented by this; that is, to take the average of that common soil down there.

A Delegate—They ought to plant that country to apples down there and furnish fruit for the northwest.

Professor Hopkins—That is the fruit belt of Illinois. That is one of the great industries there. It is very important. Large orchards are planted now. We have in the plowed soil 3,150 pounds of nitrogen, and we should have 5,800. Compare it with the black clay loam. We have 600 pounds of phosphorus down there, and that is the element particularly that the soil is short in; we should have 2,000 pounds. We have got less than one-third the amount of phosphorus. We have got a little over half as much nitrogen as we need, but less than one-third the phosphorus. Our potassium is almost up to normal—5,220 pounds, as against 5,300. But the potassium is not very readily available, because the organic matter is so deficient. These mineral elements are made available or soluble to quite an extent by the fermentation of the organic matter. As that rots in the soil, it tends to liberate the phosphates and potassium compounds, the organic acids attacking them and making them soluble. But although a soil may have considerable mineral plant food, unless there is some organic matter decaying in the ground, it does not become available for the plant.

Notice the effect of treatment. We have a plot of ground where we put on no treatment, and we got seven bushels of wheat to the acre. We applied nitrogen to the soil, and we have eleven bushels to the acre. Where we applied phosphorus, we have twenty-five bushels to the acre.

A Delegate—Does that mean phosphorus alone?

Professor Hopkins—Yes, sir,

A Delegate—Is this application made sufficient to make what you would call the normal standard?

Professor Hopkins—No; when we apply any materials to the soil, if we apply material in what is known as a readily available form, like bone meal, we put on enough for a 100-bushel crop of corn. That is the standard for applying available plant food. And if you want to know, at any time, how much to put on, take that text book that I had yesterday morning, and just notice how much plant food is required.

A Delegate—In this experiment, is that the way you did?

Professor Hopkins—Yes, sir. I want to qualify that just a little. We do not put on the amount just for one year, but we plan for the rotation, and if we have a three year rotation, we put on three times as much as is needed for one big crop, and then don't put on any more for three years.

A Delegate—Is it safe to do that where you have sandy or gravelly subsoil?

Professor Hopkins—You must consider carefully what you are doing. If you are going to put on material like steamed bone meal, there is no objection, because that does not become available except as the plant takes it. That is, the phosphorus does not leach away, unless you use acid phosphate, which is already soluble. Then you might lose a good deal in sand or gravel soils. But if you are going into market gardening, and put on sodium nitrate, about three applications during one season is about the best way to apply that material.

A Delegate—Is steamed bone meal not soluble?

Professor Hopkins—No, sir; not in water. It is soluble in the juices of the plant.

A Delegate—How about the rock phosphate?

Professor Hopkins—The rock phosphate is insoluble too, and it is much less readily soluble than the steamed bone meal. We have to take very great pains with rock phosphate to make it soluble.

A Delegate—Does lime make it soluble?

Professor Hopkins—No; to mix lime with phosphate tends to keep it from going into solution. And I don't believe in mixing lime with the phosphate when it is applied. I apply phosphate to the soil and plow it under, and then apply lime to the top afterwards, and work it in.

A Delegate—How much lime do you apply?

Professor Hopkins—That depends on the needs of the soil. I would say, roughly, that a soil which has grown clover well before, but where the clover is failing on it in recent years, and where you are pretty sure that the failure is not due to the phosphate being worked out of the soil, on that soil a ton to the acre, once in five or six years, of ground limestone, ought to be plenty. On a soil such as the lower Illinois glaciation, where the principal type of soil never has grown clover, because it was too sour to begin with, there we find that we ought to put on from two to four tons of ground limestone. Two tons will do pretty well, if it is thoroughly well distributed, and fine; but three or four tons is better. Of course it will last longer.

A Delegate—Do we need lime in northern Illinois?

Professor Hopkins—Not very much. The thing that we need most on the ordinary prairie soil is phosphorus, as I will show you. Lime does not produce much effect, but it will benefit the clover some, on old, worn land.

A Delegate—What do you use on alkali land?

Professor Hopkins—Alkali may be in any kind of soil. Alkali is a poisonous substance, and there are several different kinds of it. The alkali of the west, in the arid regions, is known as black alkali. That is sodium carbonate, and I want to ask some of the yesterday morning class what is in that compound.

A Delegate—Sodium, carbon and oxygen.

Professor Hopkins—Now the injurious alkali in the Illinois soils is magnesium carbonate. The only difference is in the metal. One contains sodium and that makes a very strong alkali; or you can drop off the first two syllables and call it lye, if you want, because the lye that we commonly get is a carbonate of one of those metallic substances. In leaching wood ashes, the material that makes the lye is potassium carbonate. Sodium carbonate is the common alkali of the west. It is not black, but whenever it touches organic matter, it dissolves it, and makes a black liquid, and so it is spoken of commonly as black alkali. But the material in our common soils in Illinois is chiefly magnesium carbonate. It is always associated with calcium carbonate; that is limestone. That is well to remember. But the magnesium carbonate, when in excess, injures the crops.

A Delegate—Would you suppose that ground limestone has the same effect on the land as burned lime?

Professor Hopkins—I want to explain a little more about this alkali. I want to say that alkali may be present in any kind of soil. I have found alkali soils that were sandy. Then we find alkali soils that are peaty. At the other extreme, I know of another soil that is almost pure sand, that has alkali in it. And then you may have a good stiff black clay loam, that has alkali in. It has not anything to do with the corn position, so far as the plant food is concerned; contains the same quantity of nitrogen, phosphorus, and potassium as the good soil, but in addition to that, it contains the alkali.

I think you can understand the formation of those alkali soils from a little description that I can give you, and perhaps it would help you to know whether the soil that you have is really an alkali soil. One gentleman described his soil to me, and I am positive, from what he said, that it is an alkali soil. The alkali is contained originally, in the soil and subsoil, and is leached out by the drainage waters; so that the water, as it passes down through the lower stratum of the soil, carries with it these alkalies. It carries carbon dioxide in the rain water as it enters the ground, and that makes carbonic acid, and that dissolves the magnesium, as magnesium bicarbonates, and that goes down with the drainage water. And where those waters collect, if you evaporate them to dryness, you get alkali. And if you use a teakettle with such water for quite a long time, you will find the alkali will collect in the bottom as a scale. You will get a quarter of an inch of this same material, containing magnesium carbonate and calcium carbonate, mixed together. Where these waters, during the years past, have run into ponds or large sloughs or small lakes, there has been somewhere a bank or shore; and during the summer time, the water has crept up into that bank or shore, by capillary action; the same action that draws the kerosene up to the light through the wick of your lamp. When you bring this water in contact with the shore, the soil takes the water, and soaks it up. The water will creep up into the land for three or four rods, and then it evaporates, and more creeps up, and that process goes on, and as it evaporates, it leaves the alkali that is contained in the water. So you have a process there of concentration; the accumulation of alkali in that soil. You may have that occur in several different places. You finally come and drain the water out of that pond, by a deep ditch or tile drain, and the bottom of the pond is all right, because that did not have the deposition occurring there. And so, when it is drained out, and you put it all in cultivation, you have a good soil in the lowest ground, and a good soil up on the higher land, but there are two or three or four rods along the border of that old pond that contain alkali. You may have that alkali condition in the very highest land on the farm, but that is a case where the farm was all under water except those high places; where your farm was really all a slough, except here and there little knolls; and the alkali water soaked into them and evaporated, not one year, but hundreds of years; going on for long periods of time, every season. And so, we find the very worst spots, sometimes, in drained-out lands, are the high places, but formed in exactly the same way.

There is one other condition when it occurs, and that is, when there were small ponds scattered over the land, and they dried out every year. There the water evaporated entirely, and left the alkali in the bottom of the pond, and then the very bottom is the worst. Thus, alkali may occur in peaty soils, in the richest soils, or sandy soils, or in any other soils.

Two or three things can be done as a remedy. One is by working organic matter into the soil. As the organic matter ferments, particularly organic matter that ferments quickly, like what you call hot manures, or manures that decay quickly in the soil, such as horse manure, it forms organic acids, which unite with the magnesium carbonate, and make compounds that seem to be harmless. Then the increase of organic matter in the soil tends to stop the evaporation and bringing of the alkali from the lower subsoil up to the top of the ground. You know where the alkali spots are, if you have a wet period of time, and then it comes off dry afterwards; this capillary attraction brings the water to the surface, and that leaves a white crust on the top.

Another thing is to increase the amount of water that goes into the soil when the rain falls, and that water soaks down through. In connection with that, we should always provide and use good drainage; thorough tile drainage underneath—and don't be afraid of putting too many tile in that sort of soil. I have known some of those spots to be cured permanently by thorough tile drainage, that was made to work. It is necessary, sometimes, to put in the tile and put cobs around it, or straw, or brush, or anything to increase the working of the tile, so that they do not stop up. Those are the only practical ways that have been worked out, so far. There is a method, which we call a scientific one—those others are scientific, too, so far as that is concerned—but there is another, which can be applied, but I am not sure whether it can be done with profit; and that is to take the magnesium carbonate, which is in the soil, which is very difficultly soluble, and make it perfectly soluble, so that it will go out quickly with the drainage water. Those soils will gradually improve, with good drainage. Perhaps it would take a good many years, and perhaps longer than a lifetime, but we can make that magnesium carbonate perfectly soluble. I do not hesitate at all, before the Illinois State Farmers' Institute, or before many county institutes, to use some of these chemical names, which are the simplest possible names, because I find that people understand them pretty well. There are farmers in Illinois that know about as much about these different chemical compounds as some professors that teach.

Magnesium carbonate has this formula: $MgCO_3$. You see what there is in it. It is just the combination of all of those elements; that is all. And why should not a farmer know that, when he sees it, and understand the reaction that occurs? One atom of magnesium, one atom of carbon, and three atoms of oxygen. That little figure there, or such a figure after any of the letters of a chemical formula, means the number of times that the element is taken. Now, we can add to that soil a material that is commonly called land plaster, but that is not a good name for it, and I would not advise anybody to keep on using that name. I would say calcium sulphate. It isn't any longer, and see how much calcium sulphate means to us. You all know what it is. What is it? The element calcium, combined with sulphur and oxygen. That tells you exactly what it is. It means much more than land plaster does. When you add that, you get Ca, which is the abbreviation for calcium, S, the abbreviation for sulphur, and oxygen four times. That is the material that we add. And then, we say, a reaction occurs. By that we mean there is an exchange among these different atoms, and after that occurs, we have not got the same things left, but in different combinations. And you will see how simple it is. We put together magnesium carbonate, $MgCO_3$, and calcium sulphate $CaSO_4$, and after the reaction, we have $CaCO_3$, or calcium carbonate, and $MgSO_4$, or magnesium sulphate. You will see that the calcium and magnesium have just changed places. That is all there is in it. You know both of these materials. This one is limestone, you remember. We did not put in any calcium carbonate; there was no limestone added, but after the reaction, we have limestone. That doesn't do any harm in the soil. It is better to call it magnesium sulphate, but we know it as epsom salt, and that it is perfectly soluble. By simply putting in thorough drainage, and then putting on enough calcium sulphate, or land plaster, to make this reaction, then this soluble magnesium sulphate will be formed and it will run off in the drainage water; and thus we have removed our magnesium in that way, and I don't think there is anything difficult in it at all, but what anybody can understand. It will take it out down so far as your tile are. And I try to get tile in the soil always three and one-half to four feet deep. If you put it in that deep, and then put on enough of this calcium sulphate to perform that reaction, then as soon as you have sufficient rainfall, you will have it leached out. But the question is, whether we can afford it. I am inclined to think we can, on many soils.

A Delegate—What would be the ordinary cost per acre of this application?

Professor Hopkins—That depends altogether on the amount of magnesium carbonate in there. These reactions occur in definite quantities, always; that is, if you have a certain quantity of magnesium carbonate in the soil, you must add a certain amount of calcium sulphate to get it out; otherwise, you won't get the reaction completed. It takes one atom of calcium to replace one atom of magnesium in that compound. We say that the atomatic weight of magnesium is 24. That is based on hydrogen being 1. We can say for every 24 pounds of magnesium in the magnesium carbonate, we must add 40 pounds of calcium in the calcium sulphate. We know the atomatic weights of all these. Magnesium is 24, and carbon is 12, and oxygen is 16. It is not very much to learn the reacting weights of these different compounds. So if we have 6 tons of magnesium in the soil in the form of carbonate, making 21 tons of magnesium carbonate, then it would be necessary to put in 10 tons of calcium in the form of calcium sulphate, thus requiring 34 tons of calcium sulphate to complete the reaction. And it is going to take a good deal of it, on most of these alkali soils, if we perform the correction this way, and I am not ready at all to advise that we do it, until we get more definite data, and know how it is going to work on the fields.

But we can afford to spend a good deal of money on one of those patches. The alkali patch usually is half an acre or an acre in the field; just a strip, four rods wide, maybe; such a strip forty rods long would give you such an acre of land, and perhaps it just crooks around everywhere. As a matter of fact, you would do all the work necessary to grow a crop of corn on it, when you grow corn in the field. You can not afford to stop and turn, and leave out the little strip. But you plow the ground, and cultivate it, and plant the corn and go through all the motions and expense of raising a crop of corn on that land, and get nothing for it. Now, if you can correct it, it may be just as rich ground as any in the farm. And if you can correct it, then you get something for a return. If your land is worth $150.00 an acre, it might be profitable to pay $200.00 an acre to correct that strip; not because it would be worth more than $150.00 but because you are losing money on it now. It is an actual expense every year. But if you find that you can correct those patches by this reaction for $50.00 an acre on land worth $150.00, it will pay you to do it.

Then there is one other thing that I think appeals to most farmers, and that is the beauty of uniform land. Non-productive spots are eyesores on the farm. And I know there are farmers who would give $100.00 to get rid of a quarter acre alkali patch in a field, if for no other reason than because it will look better.

A Delegate—In our land, we have a large amount of this so-called alkali land that borders our swamps, and we generally suppose the land needs potassium. Would potassium do these spots any good?

Professor Hopkins—Not if it is truly alkali land. If you read bulletin No. 93 on soil treatment for peaty swamp lands and alkali soils, you will see that the distinction is clearly made. It may be that potassium will help it, if it is a peaty soil. You do sometimes have a condition where those two things go together. A peaty soil that is also an alkali soil is a soil that usually responds to potassium treatment more markedly than any other soil. And there may be quite a little potassium in the subsoil, but the magnesium carbonate in the subsoil won't let the roots go down.

A Delegate—There was a question raised, and you stated that you had to use enough to neutralize all that magnesium carbonate, in order to get any good. If you put on some calcium sulphate, it would do some good, would it not?

Professor Hopkins—That depends on how much. I do not mean to say that you must take out all the magnesium carbonate. Three quarters of 1 per cent of magnesium carbonate can be in the soil, without injuring the crops much. But if you have 4 per cent of magnesium carbonate in the soil, you would not get any benefit from putting on enough calcium sulphate to neutralize 2 per cent of it, because no corn can grow in soil that has 2 per cent in. And I would say money would be wasted in putting on enough to only reduce it to 2 per cent, because you still could not grow any corn.

A Delegate—In regard to limestone, does common lime have the same effect as burned lime?

Professor Hopkins—That it is an important thing, and there again I think we must go down to the elements of it somewhat, to understand it. There are two distinct forms of lime, and there are two distinct actions of lime. We have here limestone to begin with: $CaCO_3$. That may be written in another way. We can write it as $CaO+CO_2$. And when you heat this calcium carbonate, that is the way it breaks up. It leaves one atom of oxygen with the calcium, and two go off with the carbon as carbon dioxid. That is the action in burning, and you have left the calcium oxid. That is quicklime.

That is also known as caustic lime, or burned lime. It unites with water, whenever it comes in contact with it. It still remains caustic lime, but it is hydrated; put together CaO and H_2O; that is water; and we get $Ca(OH_2)$ or calcium hydroxid. That is still caustic lime; that is, lime that is burned, and then slaked with water. And if you put your hand in that lime, and let it stand there for twelve hours, you know what would happen, I suppose. You might have the bones left on your hand, but it is not likely you would have much flesh left. Caustic means burning; caustic lime, burning lime. Ground limestone will not do that. You can put your hand in ground limestone, and it will not produce that burning effect.

A Delegate—How about air slaked lime?

Professor Hopkins—You take water slaked lime, that has had water added to the quicklime, giving us calcium hydroxid, as we say, and if you let that come in contact with the carbon dioxid of the air, it goes back again to the form of calcium carbonate, $CaCO_3$, so that thoroughly air slaked lime is just the same as ground limestone; absolutely no difference in it; and it won't do any harm; that is, it won't burn anything.

Now, as to the two actions of lime, from these two different forms, one action of the lime is to correct the acid in the soil. The calcium will unite with any acid in the soil that is stronger than this weak carbon dioxid or carbonic acid. That is the weakest acid known, and you can bring calcium carbonate or sodium carbonate or any of the carbonates in connection with any other acid, and it will drive out the carbonic acid, and take the calcium to itself. If you were to add to calcium carbonate sulphuric acid—and the only difference between sulphuric acid and calcium sulphate is the hydrogen instead of calcium; I wish we could call that hydrogen sulphate, but that has never come yet. It is hydrogen sulphate, but we call it sulphuric acid. If we could bring those two together, then the calcium will displace the hydrogen and the carbonic acid will pass off as a gas, and calcium sulphate is formed. Now, bring calcium carbonate in connection with the acids in the soil producing the sour condition, and the element calcium will unite with that acid and make a neutral salt, which is not acid, and not sour any more. Take sour milk and add soda to it, and it won't be sour any more. Soda is sodium carbonate. Add the carbonate of soda to the sour milk, and it will form, and the gas carbon dioxid will go off, and it will form sodium lactate, because the acid in the milk is lactic acid, and the salt that is formed is sodium lactate. Lime acts similarly in the soil. You can do that not only with calcium carbonate, or air slaked lime, but you can do it with quicklime or calcium hydroxid. Any of the forms of lime will correct the acid. That is one action of lime on the soil, and I think that is the only legitimate use of lime, in all general cases.

The chief importance of correcting the acid in soils is so that the bacteria which live on legumes will thrive and develop in the soil. They will not develop in acid soil and do their work properly. A few will live, perhaps, but the plant does not do well, and usually it is a failure. And thus the special value of adding lime is to correct the acid, so the bacteria will live and do well. I do not know of any way that we can tell, except by testing it with litmus paper. Take a spade and run down into the soil and part it, and then put a piece of blue litmus paper, which you can buy of any druggist, against it, and leave it perhaps twenty minutes. And if it has turned red, and redder than another piece of blue litmus paper that you moisten in pure water, then you will know that the soil is acid. Another way and perhaps the best way, is to take the data that the experiment station is putting out.

Look at this circular that I gave you yesterday morning, and you will find that a particular type of soil, in the lower Illinois glaciation, requires 2,400 pounds of lime, as an average, to correct the acids in it. I believe that 75 per cent of the people that live in the twenty-five counties in that soil area can use such data on their soil. That is all I have to guide me on my farm. I have a farm in Marion county, and I have not tested the acidity of the soil within five miles of it, and may never do so. But you know that I have got the common prairie soil there, and I know where that soil has been sampled and analyzed in twenty-five or thirty places, that it is always just about the same. And so I am putting on my farm, without any other test, because I have confidence in the work of the soil survey, two tons of ground limestone to the acre, to correct the acidity of my soil.

A Delegate—How about this soil around here?

Professor Hopkins—But I want to finish this other question, about the two actions of lime. I have explained the one action, the correction of soil acidity, and I say any form of lime will do that, and that is all that ground limestone or old air slaked lime will do. But burned lime, quicklime, or fresh air slacked lime has this burning property, this caustic property, and it will not only destroy the flesh on the hand, but it will destroy the organic matter in the soil. And it will also tend to decompose the mineral parts of the soil, and liberate some of the mineral plant food. If you take the two kinds of lime, limestone and burned lime, and put on the same quantities, the first year you will probably get more marked results from the burned lime, because it will correct the acid in the soil, and also tend to liberate nitrogen and phosphorous and potassium from the soil, that we would not get out otherwise. But of course you do not enrich the soil by that. You will not enrich your soil by destroying the organic matter, even though you may get a little bigger crop that year. Lime used in that sense is a stimulant, and usually, by a stimulant, we mean a destroyer. Burned lime, you might say, has the same action upon the soil, as alcohol has on the human system. Alcohol is in no true sense a food. The ordinary action of alcohol produces a stimulating effect, and it is a destructive process. And so you can sometimes stimulate and destroy the soil by applications of caustic lime. If there is any way of reducing the fertility of a soil more rapidly than by using burned lime on it, I have never found it. And the history of the use of burned lime on soils in the older countries is well known; so much so, that there is a national proverb in Germany that has become known almost all over the world, and many of you will recognize it in its orginal form, I think.. The Germans say, "Kalk macht die Vater reich aber die Schne arm." Translated it is "Lime may make the fathers rich, but it makes the children poor." That refers to burned lime, and to its stimulating action on the soil. It may last for ten or fifteen years, if you continue to use it. But when your soil goes down under burned lime, then it goes very low; and that is what I call an illegitimate use of lime. I think there are times when you can get lime so cheaply in the burned form, or get hold of waste lime for nothing, that perhaps it is better to haul it out and spread it, and lose some of the organic matter, than to pay out a good deal of money for ground limestone taking special pains to replace the organic matter destroyed. But whenever any people begin to use lime in quantities, they are going to use ground limestone if they build up their soil. Because when you come to use carload lots, the ground limestone is cheaper, and it is much simpler and easier to handle. Burned lime is one of the most disagreeable things to put on soil, while the ground limestone has no burning action if you get it on the skin. It is just a dust, and it does not have any injurious effect.

About the method of applying this lime, there are a good many different ways. It can be spread with a small shovel, right from the wagon, as you drive across the field. You can apply it with some of the strongest endgate seeders, and some of the agitator force feed grain drills or grain seeders, where the axle runs right across the bottom of the box, without gearing. You can use those, but they are not very satisfactory, because they are not made strong enough. There is a machine which is made by a firm down at Chicopee Falls, Mass., the Belcher & Taylor Agricultural Tool Company, a machine known as the Steven's Fertilizer Sower, the larger size of which is about eight feet, three inches long, that will sow a strip half a rod wide, and which is strong enough so you can sow three or four tons to the acre. I am using one of these machines. But it has also been discovered that farmers can make a machine themselves, with the assistance of an ordinary blacksmith for about half the price of this eastern machine, and that works just as well. Take a couple of old mower wheels, and cut the axles off about three or four inches from the wheels, so as to leave the ratchet, and have a rod welded in about eight or eight and a half feet long, so your wheels are about nine feet apart, and then fasten on to that rod some sort of an iron strap, so as to make a little reel three or four inches in diameter, and build a box around that. Put a frame in, and put a tongue on, and the reel will turn with the wheels when it is pulled forward. Then put in a double bottom of heavy sheet iron or light sheet steel and have the lower bottom made to slide endwise. Then attach a lever to that bottom or slide, and also a little bit above on the box, and have it stick up so that it can be pushed back and forth. Put holes through both bottoms, and adjust it so that when the lever is thrown one way, the holes all close, and when it is thrown the other way, they are all open. Put oblong holes about one by two inches, three inches apart through the bottom.

The Ohio Experiment Station has made one of those, and a good many farmers are making them, and they say they can sow any quantity they wish, and they have no trouble with them, and can make them for about $15.00 or $20.00 expense, if they have the old mower wheels to start with.

I am sorry that I cannot refer you to any Illinois people who advertise the sale of ground limestone. It may be that you can get ground lime from some of the crushers, where you can get the dust sifted out. But the only place that I know of, anywhere near Illinois, that you can get it, is from the Crystal Carbonate Lime Company, of Ellsberry, Mo., or from the Mitchell Lime Company, of Mitchell, Ind. There is no reason why we should not have plenty of ground limestone in Illinois. We have plenty of limestone. Where you can get it for the hauling, you need not be too particular about the quality. The limestone in this region is not of very high quality; but still, if you can get it for a very slight expense, that does not matter much. If you are going to ship it, however, so that you pay $1.00 for the material, and $2.00 for the freight, then you had better have pretty good material. But we have excellent limestone along the Mississippi, and there is plenty of limestone down around Anna, in the Ozark hills, and there is no reason why plants should not be put in, and have that limestone crushed and hauled where it is needed. I have tried to get the Illinois Central Railroad Company to put in a plant at Anna, and I have also suggested the matter to several lime companies, but thus far no limestone is being ground in this State. I am getting ground limestone from the Crystal Carbonate Lime Company. They charge $1.00 a ton loaded on the cars, and then I pay $1.70 freight, because my farm is on a north and south line requiring a change, but on any cross line you can get it for about $1.50 freight.

A Delegate—What effect would wood ashes have on the soil?

Professor Hopkins—That is an important question. Wood ashes contain about 1,000 pounds of calcium carbonate to the ton. In other words, they are part limestone, just like old air-slacked lime. And commonly the chief action you get from the wood ashes is due to the limestone they contain. They contain about 5 per cent of potassium and on soils that are deficient in potassium you get that benefit. But people very commonly think that the effect of wood ashes is due entirely to the potassium, or potash, as you more commonly say, perhaps. When we first began studying southern Illinois soil we found a man who said that the soil is deficient in potash, because ashes produced a marked effect, especially on cow peas and clover. Of course they do require large quantities of potassium, but when we come to put potassium on the soil we find that is not what it needs and that the effect of wood ashes is not due to the 100 pounds of potassium contained in a ton, but to 1,000 pounds of lime. It is usually one or the other. On peaty swamp soils, if you put on heavy applications of wood ashes, the potassium would be the thing that would help. But on ordinary soils the thing that helps is lime. For treating acid soils, leached ashes are worth almost as much as unleached; not quite as much because the potassium carbanate has the power to destroy the acidity of the soil the same as the calcium carbonate. But on peaty soils they are not worth much of anything, because the potassium is leached out.

A Delegate—What is the value of the average quality of limestone to apply to the average prairie soil? What could you afford to pay?

Professor Hopkins—I don't think that I can answer that definitely because I don't have information enough. The soils in some places are growing a little acid, and when this is the case, if limestone is applied the clover grows better and the corn grows afterwards. But in the better crop of clover the effect is due to the nitrogen you are getting from the air and you are still taking more of the other elements of plant food out of the soil. So that no one should think that the use of lime to correct the acidity of the soil is the only thing that needs to be done. You must get at the other elements also. [Applause.]

THURSDAY MORNING.

On Thursday morning, Feb. 23, 1905, at 9:00 o'clock, the class in soils met at the opera house, with Mr. Ralph Allen, superintendent, in the chair. Professor C. G. Hopkins, the instructor, spoke upon the subject of "The Balanced Rations for Plants," with special reference to increasing the value of stable manure and green manures.

PROFESSOR C. G. HOPKINS.

I think, regarding the use of manure and legumes, like everything else, we can understand somewhat the different actions those things have, and then work out the factors that produce the effects. Legumes and green manure and ordinary farm manure all come under the head of organic matter, that is, they are means of adding organic matter to the soil.

We continually speak of the fact of organic matter improving the physical condition of the soil. Now, that is a very broad and general statement. Improving the physical condition of the soil! What do we mean by it? If we can work out the individual factors, then we shall see what the action is. I can think of four physical conditions that we can effect by increasing the organic matter in the soil.

We can make the soil more loose and porous, and thus improve the conditions that such a plant as corn requires, for the roots to penetrate in the different directions in the soil. Furthermore, the oxygen that is necessary for nitrification, and for other processes going on in the soil requiring oxydizing agents, and the nitrogen necessary for the bacteria of leguminous plants must get into the soil, for you know they must get their nitrogen from the air. That is one effect that we can produce by means of organic matter and in other ways.

Another effect is upon the moisture content of the soil. We can, by adding organic matter to the soil, increase the power of the soil to absorb and retain moisture. That is, to take the water in as it falls upon it. We can do that in other ways also. Help it by deep plowing and by tile drainage. Take a soil that is hard and compact, containing little organic matter, such as the principal type of soil in the lower Illinois glaciation; you may have an inch of rainfall upon that land, and perhaps three-quarters of that rain will run off the surface, and probably one-quarter of it soaks into the ground. Take the same soil, and plow it deeply. and work in plenty of organic matter, and which will tend to hold it in that condition much longer than if you did not have it. You can get a dashing rain upon it, and it will not run together and become compact again. You know that when you plow sod, you are not much afraid of it running together and becoming compact, because there is lots of organic matter in it. If the organic matter goes to considerable depths, as will be the case if it is deep rooting crops like clover, then you have those little roots, fairly good sized roots, running perhaps two or three feet into the soil. It may have been growing for two years on the land, and those roots run to considerable depths in the soil. You plow that clover sod and cut those roots off, and they die, but every root simply becomes a sponge, like a lamp wick, only smaller. It has the power to draw in water very rapidly. It will shrink a little and leave a little space around it that will draw the water in by capillary action, and if you have thousands and millions of those roots running down into the soil two or three feet, you will see how they effect that factor of absorbing water by the soil.

There is another factor that we can effect, and that is the temperature. That is physical. All of those that I have mentioned are physical factors—loosening the soil so the roots can branch out easier, then controlling the moisture, then the temperature of the soil. I mentioned yesterday something of what we can do by allowing the water to run off in drains, and not trying to evaporate it from the surface, warming up the soil earlier in the spring. I call to mind an illustration on the university farm last spring. We put in a good deal of tile drain on our newer experiment fields which we laid out. We had part of the drainage in the fall before, and the rest we were unable to get in until last spring. Where we had the tile drain in, we could work the ground last spring from ten days to two weeks earlier than where it was not drained. And it is not flat ground either. It happened to be a wet spring, and plenty of water falling, and that undrained land kept just about enough water in it so that we could not plow it up for ten days or two weeks after we worked the other. The organic matter affects the color of the soil. That is what gives our soils a dark color. We take any of these soils. even the black clay land, and we put that soil through certain processes. and take the organic matter out of it, and we have white soil left. Almost pure white. You couldn't tell the soil then from that southern Illinois land that looks pretty white to begin with. Sometimes we have sufficient iron in the soil to give it a reddish cast, and that increases the depth of the color. Professor Mosier, who has charge of the work in soil physics at the university, has been carrying on some very interesting experiments to see what could be done to affect the temperature by changing the color; and he found, for example, last year, where he took a gray soil that was quite deficient in organic matter and put it into a tray, and put in thermometers, and then took another tray of the same kind of soil, and sprinkled over that perhaps an eighth or a quarter of an inch of dark loam, and put the thermometers in that tray and then exposed them both to sunlight, that the soil covered with the dark layer would average about five or six degrees higher in temperature during part of the day than the other. Then he put seeds of corn and oats and other grain in, and they would germinate more quickly in the dark soil than in the light soil. You probably have noticed that where you work in plenty of organic matter in the soil it is a darker soil. Farmers notice that where clover is raised, it is a darker soil than where you have not grown clover, side by side.

Thus we have three physical effects that may be produced by the addition of organic matter—increasing the porosity of the soil so that air and plant roots can penetrate it more easily; controlling the moisture content; and controlling the temperature. To these might be added the prevention or lessening of surface washing. And I do not know of any other physical effects which we can produce by farm manures or by legumes or green manures, except the improvement in tilth, as in decreasing tenacity or increasing friability.

There are other effects produced by organic materials, but they do not apply to the physical condition of the soil. They apply to the plant food supply, and our conditions may be such that the organic matter we are adding is influencing the soil, but not in a physical way. Perhaps those physical features are all right, but maybe the beneficial effect produced is due to the plant food added or liberated. You know of differences between different manures. Every farmer has learned that some manures are better than others; that we have rich manures and poor manures, and manures hardly worth hauling out. So far as controlling these different factors that I have mentioned, a ton of manure, containing a certain quantity of organic matter made from wheat straw, would be just as good as a ton from clover hay or bran. But you know that there is a difference. And so we have a value of manure, dependent upon its plant food contents; upon the amount of plant food it will furnish as it decays in the soil.

Then there is another action that we are not likely to take into account. That is the action of the decaying organic matter upon the inorganic content of the soil itself in the liberation of mineral plant food. That is what I would call a stimulating action; for manures or clovers or green manures of any kind, that liberate plant food from the soil, are stimulant to that extent. I don't want to say they are not good to use in many cases even for that purpose, but we should understand the matter and not think we are adding something to the soil, when we are really liberating something from the soil, as in the liberation of phosphorus by clover. When manure decays in the soil it forms organic acids, and those acids attack the mineral constituents of the soil, and they dissolve the phosphorus and potassium contained in the soil. If this is the effect of growing clover on the land, the principal effect, then we must not think that clover alone is all we need to have. It is really a way of getting such plant food out of the soil rapidly.

In order to illustrate that, I want to show you some data I have here on this chart:

UNIVERSITY OF ILLINOIS SOIL EXPERIMENT STATION.

LATE CORN YIEDS FROM EXPERIMENTS BEGUN IN 1876.

PLOT NO.	Crop Rotation	Soil Treatment.	Corn, 1904.
3 N.....	Corn since 1876........................	None..........................	22
4 N.....	Corn and oats since 1876	None..........................	36*
5 N.....	Corn, oats and clover since 1876.........	None..........................	59
302-3....	Pasture 1876-1894—Corn, oats and legumes since 1895.......................	None..........................	75
304-5....	Pasture 1876-1894—Corn, oats and legumes since 1895.......................	Lime..........................	86
306-7....	Pasture 1876-1894—Corn, oats and legumes since 1895.......................	Lime phosphorus.............	96
308-9....	Pasture 1876-1894—Corn, oats and legumes since 1895.......................	Lime phosphorus potassium..	95

* 1903 yield. (Oats were grown in 1904.)

These results have been obtained from the university soil experiment fields, and the work covers now twenty-eight years. Professor Morrow, whom many of you will remember, perhaps, laid out the first part of these soil fields twenty-eight years ago. That work has come down to me, as I have been placed in charge of the soil work, as one of the most valuable heritages; and I think we owe Professor Morrow a great deal for his foresight in laying out some of the work so many years ago and keeping records as well as he could. We don't know the records of the yields of the crops on these fields for the first few years. So far as I can learn, Professor Morrow was not able to get help enough to weigh the products. The university farm was run during those days with the sole thought of making money. It was supposed to be laid out as a model farm, and if it did not make money and yield a revenue every year, then it was counted that it was not successful. and that the university people did not know how to farm as well as other farmers did. They did not conceive of the idea of carrying on investigations and trying many things that were not likely to pay, but to prove that they would not pay. It is not profitable to raise one acrce of corn. That is not the way to raise corn. We want a forty acre field; but if we put out corn on one forty acre field, and oats on another, about a four year rotation is all we can have on the university farm. And you cannot get two forty acre fields alike. There are wide variations. But the entire plan there for many years was that everything that was done must yield immediate profit, not that it must be of immense benefit to the State, so that they could get at the results and apply them from real investigation, but that it must be in itself a profitable undertaking. It was not immediately profitable to harvest these different lots separately and weigh them, for it costs money to do that. Some one better than a boy working at sixteen dollars a month must be employed to look after such work. And Professor Morrow could not hire anyone to do that. He had no funds. If he had taken the records he would not have had any revenue to turn over. So while he did keep the crops growing, and he grew corn on the plot that was to grow corn, it seems he was not able to harvest it and weigh it by itself. He may have had no scales. You know the State never began putting any money into this investigation work until four years ago, although we did get some help from the United States government some fifteen years ago.

We have here a field (Plot 3 N) which has grown corn continually for twenty-eight years without any treatment whatever. Soil treatment, none. That means there has been no manure put on it, and no fertilizer and no such treatment of any kind. The entire crop has been harvested and removed every year. And this year, 1904, we have twenty-two bushels of corn to the acre on that land. That plot was the same kind of ground as all the rest of the place must have been, and twenty-eight years ago you would have said it was all the same kind of land; and you will say now if you look over the fields that it certainly was the same kind of land to begin with.

On this same kind of land another plot was started for a rotation of corn and oats. This is the common rotation in Illinois. Usually it is not a two-year rotation, although in many places it is; corn one year and oats the next. In other places they run two years of corn and one of oats, and then back two years of corn. And sometimes they have the same rotation in corn that a southern Illinois farmer told me they had in wheat. I asked a man in St. Clair county two or three years ago what rotation they followed, and asked him especially what he usually grew after wheat. He says, "That always depends on the crop of wheat. If we get a good wheat crop, we grow wheat afterwards." And that is true of the corn rotation in many places. Just as long as the land will grow a fair crop of corn, they keep corn on it and then go back to something else.

A Delegate—Why did you keep this plot in corn for twenty-eight years?

Professor Hopkins—We did it to show that it is a bad system, and we want to show the farmers before they reach the point how bad a system it is to carry that on, in comparison with other systems. The entire crop is removed.

We also have corn and oats in rotation (Plot 4 N). We want to see what effect that will produce. This year we had oats on the field, but last year we grew corn, and we got thirty-six bushels of corn to the acre last year. All other crops are 1904, but this one field is a 1903 crop. The continuous corn plot yielded twenty-six bushels in 1903, and the corn and oats rotation yielded thirty-six bushels. This year, 1904, this corn plot yielded twenty-two bushels, and we would probably have gotten thirty-six or thirty-eight bushels of corn from the corn and oats plot if it had been in corn.

Then we have a different system in Plot 5 N; in corn, oats, and clover for twenty-eight years, and this year it made fifty-nine bushels of corn to the acre. I think we might well stop and look at that a little time. You will say right away perhaps that this is the better system, and that this is the better preserved land. Now, as a matter of fact, I think this continuous corn land is a little more an acre now. It is worth more because we have not taken so much off of it. It has produced smaller crops, and if we were going to buy one of two farms, of which one had been in continuous corn, or corn and oats, for the last forty or fifty years, while the other had been growing corn, oats, and clover, without anything going back on it, and had been making up to the present time perhaps 50 per cent larger yields, I believe I would buy the land which had not grown clover, provided, of course, it is level land and has not been injured by surface washing. You buy that land and begin to put clover on it, and you will undoubtedly find it will soon go above the old clovered land in crop yields.

Clover adds just one thing, nitrogen. But it does not add to the mineral elements of the plant food in the soil. And nitrogen is an element regarding which we are quite independent. Nobody is ever going to get a corner on nitrogen, because at the present market price there are $11,000,000.00 worth over every acre. Some people have questioned a statement of that kind very much. You know that nitrogen is reckoned at 15 cents or more a pound in America, and that we have fifteen pounds atmospheric pressure to every square inch of surface and the air is four-fifths nitrogen. Figure it yourselves.

It is those soil elements that you have to depend upon the soil for that we should know how we are going to keep up. We can maintain the nitrogen by plenty of legumes in rotations, but that is a system which depletes the soil of the mineral elements more rapidly than one without legumes. You see the reason for it; because we take off larger quantities of mineral plant food just to make the large crops. The best farmer is the man that takes the most plant food out of the soil. These are the best farmers and the most successful farmers; but it is rather a temporary success unless he puts it back again if it needs to go back. I would not advocate at all putting an element of plant food in the soil where that element of plant food is not needed. If you have sufficient phosphorus in the soil so that it does not limit the crop at all, it would be folly to take off the crop and immediately go and put the phosphorus back that you take off. Because it would not benefit it. We can work any of those elements down until it becomes a limiting factor in the crop; and when the phosphorus begins to put our corn crop down to about seventy-five bushels per acre, then I would say we had better put that element back, because that is holding our yield down.

A Delegate—Was the clover sowed after the oats there?

Professor Hopkins—Yes, sir; and carried over the second year, and the clover hay is cut off, and if the seed crop is a good crop we cut it off, and if it is not, we plow it under. The system that we adopt we try to make a practical one, so that it can be applied by anyone. Our method of farming is certainly not practical, because it is not practical to do farm work on half-acre or tenth-acre lots and weigh everything, and perhaps dry out the corn and get the dry weight.

But we try to make the system both as to rotation and soil treatment such as would be practical to anyone, so that whatever results we get on a ten-acre plot, we can put on 160 acres, if desired.

A Delegate—Sowing oats and clover had a tendency to increase the oats yield that year?

Professor Hopkins—No, sir, I think it has a tendency to decrease it. We have a good deal of data on that, and I think in no case have we gotten a larger yield on comparative tests. That is not saying it is not the thing to do, of course, but the men who sow clover with oats have an idea that it is right, because they look to next year's crop, and that is where they get the benefit.

I tell you, gentlemen, that is where the Illinois people are going to get the benefit of all the soil work and the methods of keeping up the soil, because they can look ahead two or three years. The things we are trying to do could not be done in many other states. You can not go back in the eastern states where agriculture is at the bottom and try to work out a system and look forward three or four years for your maximum results, being satisfied perhaps with getting back the second year what it cost to do the thing, the same as sowing clover seed in oats to benefit the following corn crops. You are losing money the first year, with no hope of getting a cent back that year unless you pasture a little in the fall, but you plow it under and raise larger corn crops the second and third years.

A Delegate—Is it wise to pasture after the oats is taken off?

Professor Hopkins—I think many times it is. Certainly I would rather pasture than to let the clover go to seed the first fall. I would rather clip it than to let it go to seed. If it goes to seed it is much more liable to be winter-killed.

But I say regarding this possibility of working out a system here, we are prosperous in Illinois and we can afford to begin to do something for two or three years ahead. We can afford to build up our land and make our land richer every year. If we can see that within two or three years we can be even with the world and then begin to make a little more profit, so that after that the land is going to be better the longer we farm it; if we can increase every year the stock of plant-food instead of decreasing it a little, we shall be ahead at the end of three or four years, and our system will be permanently profitable.

A Delegate—I would like to ask whether you do not think it is profitable to sow this mammoth clover and plow it in the fall to build up your land?

Professor Hopkins—That depends upon what you mean by building up your land. I would say you will get a bigger crop afterwards, and maybe for two crops, but does it build up the land in any permanent sense? You have not added any plant-food by growing mammoth clover except the nitrogen. You have not added any phosphorus or potassium. You have simply worked them out of the ground in proportion to the crop yields removed. But we must not stop growing legumes, because that is the thing we must do to maintain nitrogen and humus.

water—such as red clover, and we are doing that now—if we can do that then I think the red clover roots are, as we sometimes say, going to puncture the hard pan.

A Delegate—Wouldn't tile help that hard pan?

Professor Hopkins—We are trying that but need more time before we can give advice about tiling.

A Delegate—Then the water and the air have a tendency to loosen that hard pan?

Professor Hopkins—Yes, I feel pretty sure it is going to work and greatly benefit the soil. But people who have tried it have expected to go down there and put in tile and get the same benefit from it that they could up here in lands four or five times as rich in plant food and that they need nothing but tiling. Take these swamp lands in Champaign and other counties that are possibly the richest lands in the State; they put tile in that and immediately get seventy-five or eighty bushels of corn in the acre. That was all it needed too. But tile drainage is not the limiting factor in southern Illinois. You put tile drainage in there and you get almost no effect in the crop. But when you begin to add the necessary plant food then we can begin to reap the benefits of the tile. In every place where we have put in tile water runs out of the outlet.

A Delegate—What effect does frost have on this land?

Professor Hopkins—It will loosen it up and help it of course. But I want to get back to one point just to illustrate what I have in mind about permanent agriculture. Suppose, for example, that we have two fields here. There is one field and here is one. We apply to this soil a little more than we take off and to the other soil we do not apply anything to keep it up; and then we get yields of, we might say to start with, fifty bushels each, but the second year this one drops down to forty-nine and this one goes up to fifty-one. That does not pay for the treatment. But bear in mind you put on more than you take off. This soil is growing richer and that soil is growing a little poorer. The next year you treat this again and you find that it comes up to fifty-two, and the other you did not treat drops down to forty-eight. They are four bushels apart. That will not pay for the treatment quite. But you have the system going. The third year you are up to fifty-three bushels and down to forty-seven. And it just pays for itself the third year. But you have lost two-thirds of what you put on the first year and one-third the second year and the third year you just get your money. But the next year this comes to fifty-four and that goes down to forty-six; and that pays a little profit, and the next year this comes down to forty-five and that goes to fifty-five and then you are just even so far as your outlay is concerned and you have here crops that are increasing every year. But from experience I think we are going to make more rapid gains than one bushel, used to illustrate the point. That within two or three years time we can be getting the cost of the treatment in the increased crops and that within five years we can get all our money back and be making a little profit and building our lands up and leave our lands richer than they otherwise would be. If we can accomplish this then it would be wise to do it. That can be done in Illinois when we are prosperous and have means, when men can afford to make an investment in plant food as well as the land and can afford to wait two or three years for profit. It cannot be done where men live from hand to mouth and only get twenty bushels or less of corn per acre. Those farmers do not say, "How can we keep up our land?" They say, "How can we get enough to keep our families?" That is all. "Let next year care for itself."

A Delegate—Are there not methods by which that can be kept the first year and still make it up?

Professor Hopkins—Well, there is a method by which you can do it, but it will not be the system that we want. You can take manufactured fertilizer. and put on about one third as much as the crop takes off, in an "all soluble" form, and you can put on with that the manufactured land plaster, a powerful stimulant, and that will yield another third forcing it from the soil, and the soil will naturally yield up a third, and thus you will get a pretty good crop that year, but two-thirds of the plant food comes out of the soil, and the soil is poorer. That is what they do largely in the eastern states. When the soil gets so it will not naturally give up sufficient plant food, they force it out, and they finally force the land down, so that they cannot get enough with the most powerful stimulants, and the land has gone down clear to the bottom.

A Delegate—We are in the part of Illinois that needs the phosphorus. We feed hogs during the winter time on the land that we will plow the next spring. We feed them tankage and ground bone.

Professor Hopkins—That is a splendid system. The dairy people have a system up here in northern Illinois that is enriching the land and I am told they are making, through the dairy section of Illinois, five bushels of corn more to the acre than they made twenty years ago. Mr. Mason, of Elgin, was telling me of what he puts on his land and what he takes off and sells, and he is adding more plant food than he takes off. We know the composition of milk and of bran and oil meal, we know how much phosphorus and nitrogen there is in it, and we know what is stored in the roots of clover. And he has a system going by which he buys Minnesota bran and oil meals for feeding, and his land is growing richer. You can do it with corn land, by buying from the neighbors and putting that on the land, or you can buy the bone meal and tankage. The point I want to make is that we should adopt a system that we know is building up our land rather than running it down. I feel that the experiment station must try to work out a system that anyone can follow. We cannot advise the farmers of Illinois as a whole to do as Mr. Mason is doing. We cannot say, "Sell milk and buy Minnesota bran." In the first place, we have no business drawing upon Minnesota, as a principle. The Minnesota people ought to feed their own bran to keep up their own soil. I must try to get a system so that both my neighbor and myself can build up our farms. We will do it by live stock farming. I don't aim to sell anything off my farm except the most profitable products.

We cannot afford to sell two dollar's worth of plant food and get a dollar and a half for it just because there is some gain above the cost of labor only.

A Delegate—I read an article about two months ago in a paper in Nebraska, and this man is an extensive farmer, and he says that bone is the best producer of phosphate, and he says guano is next, and sheep manure next. I want to know whether that is the opinion of the people here or not?

Professor Hopkins—I think bone is the most sensible thing to use from the farmer's standpoint, because bone is a farm product and bone is high in phosphorus. The steamed bone meal is good. As to using guano from South America, shipping it in ship loads to some of our ports, and bringing it in by freight, it would be quite a question as to whether we ought to use that. Regarding sheep manure, I think we had better look at first principles once more. We had a splendid talk yesterday about a beef making machine, and you will remember Mr. Grout spoke about sheep. He said that some sheep were mutton making machines, and some sheep were wool making machines; but no one has ever discovered that the sheep is a phosphorus making machine. The sheep is not a phosphorus factory, and all that the sheep can turn back in manure is what he takes in in food. And there is very little difference among the different kinds of manure so far as the animal is concerned. If you put the manure on a dry basis, sheep manure is just about as rich as horse manure or cow manure. Sheep manure has about twice as much dry matter in it as horse or cow manure. Say a ton of sheep manure has about 800 pounds of dry matter, while a ton of cow manure has about 400 pounds of dry matter. The quality of the manure depends upon the feed. If you feed a rich feed, then you have a rich manure, whether it comes through a horse, cow or sheep. If you take horse manure made from clover and sheep manure made from clover, you will find them about the same. But if you take horse manure made from bran and clover hay and sheep manure made from straw, then you will find that the horse manure is very much richer.

When Dean Davenport came to the university ten years ago, he added to the series of experiment plots begun by Professor Morrow another much more extensive series. He had the plots laid out, and began to take the yields to get some of the natural productive capacity of the different plots. And that is another heritage than came down to me. On these plots, there was pasture for eighteen years; that was when Professor Morrow was there. It was in permanent pasture, and that is all we know about it. Then we had first corn, and then corn, oats, and clover in rotation. This has varied slightly from that. If our clover fails, we sometimes put on cow peas so as to keep the rotation. I think that is one of the most valuable uses of cow peas and soy beans. If your rotation clover is killed in the winter, you will then just plow that ground and plant your peas and thus maintain the rotation. Don't break into the rotation if the clover fails, but put some annual legume in place of it. We have done that once, I think, on some of these plots. We have without any other treatment, as you see, raised seventy-five bushels of corn to the acre, (Plots 302-3) whereas after twenty-eight years of corn, oats, and clover, we have but fifty-nine bushels of corn per acre. (Plot 5). That illustrates perhaps as clearly as anything that this soil is going down, because it is the same system on both plots for the last few years. But of course this newer series produced nothing but pasture for the first eighteen years of the twenty-eight.

A Delegate—Have you a record that would show whether that has gone down in the yield for the last twenty-eight years?

Professor Hopkins—We have a record for sixteen years. The yield is growing less on it. But this difference between seventy-four and fifty-nine is about as good proof as we could have, because the two plots grew the same variety of corn during the same season. The soil is bound to go down, because we are working the phosphorus out fast with clover. Potassium is abundant in this particular soil, and, will probably not limit the yield of crops for a hundred years yet, because there is so much of it. But this is not true of phosphorus.

On plots 304-5, we have the same rotation, but we added lime to it three years ago. We put lime on that in order to help the legumes. We have tested it and found it slightly acid, so we put on half a ton of lime to the acre.

A Delegate—How did you find that acid?

Professor Hopkins—You can find it by testing with blue litmus paper. We also have a quantitative analytical method which will be published.

A Delegate—In our county we think it a benefit to plow under weeds. Do you think that a good plan?

Professor Hopkins—Yes, and let them decay and liberate plant-food.

A Delegate—Will it not make the land more acid?

Professor Hopkins—Yes, but that is all right; we can not help that. It is the same as taking phosphorus out of the soil. We can not stop taking phosphorus out of the soil. But we must put it back whenever it lessens the yield. If the soil becomes acid, apply lime.

When we added lime we got a somewhat better growth of clover. It helps the bacteria to thrive and develop, and then we get a better crop of corn after it. Thus we got eighty-six bushels to the acre (plots 304-5.) But I just want it understood at this point, that so far as the mineral elements, phosphorus and potassium are concerned, that plot of ground is being decreased in fertility most rapidly. So far as the permanency of the land is concerned, that is the worst system we have, for we have not reached the point of permanently building up the land.

Let us pass on to these next plots (306-7) where we have a little different system. Here we have the same rotation, eighteen years in pasture, and then for ten years in corn, oats and clover. We added lime and then we added phosphorus, and it made us this year ninety-six bushels of corn to an acre. And we put on phorphorus enough for a hundred-bushel crop; 200 pounds of steamed bone meal to the acre.

A Delegate—How long will that give results?

Professor Hopkins—You can judge here. We took off ninety-six bushels. We put on enough for a hundred. That is a question people nearly always ask, "How long will it last?" It will last until you take it out. I think you can ask the same thing about feeding a steer. You give him a good feed, and how long will it last? It will just last until he uses it up.

A Delegate—Whenever we put on phosphorus and potassium they will stay there until we use them up, but when we work the nitrogen in, it will work away from us back to the air.

Professor Hopkins—The only soils that will lose phosphorus and potassium are the gravel and sandy soils. But all ordinary timber and prairie lands of clay and silt will hold these elements until taken out unless washed off the surface of the soil. I would not like to put valuable plant-food on very rolling land. In that case when you plow it one day, you are liable to wake up the next morning and find it all down in the valley.

A Delegate—I see in some places they are using a planter attachment for applying bone meal.

Professor Hopkins—Yes, sir. I would have this general rule, wherever we put anything in the soil as plant-food, put it where the corn-roots go and not in the hill. You know that the corn plant does not take its food right in the hill, and the tendency from putting any manure in the hill is that the first roots that come out take up this plant-food and it tends to help the corn to make a great show in its early growth, but a great many of the roots will not leave the hill. It may be it will not do any harm, and it may be it will produce quite a benefit, provided you get plenty of rainfall through the season so that the plant-food does not suffer from moisture. But suppose it gets dry and it is necessary that you have roots all through the soil to draw upon the moisture content, under that condition the corn will sometimes produce a smaller yield where fertilized in the hill than if not fertilized at all. I would not have a fertilizer attachment on a corn planter. It is too much like the eastern system of using fertilizer, just using a little dab, but not enough for the crop. There are some plants, however, that have a small rooting system anyway. I think if you are going to grow gem melons, it is all right to manure in the hill, because the root system it not extensive, and they do not live the whole season through. Perhaps if you spread it over two feet of space, it will do as well as to spread it all through the soil, but as a principle, I would say put it all through the soil for that is where the plant runs its roots and draws its moisture.

You can, I think, most economically spread any of these materials with manure. If you are going to use bone meal or rock phosphate where you are going to put manure, you can load your manure spreader half full and then put on what bone meal or rock phosphate you want, and finish loading with the manure and go and spread it. If you are making manure in the stall or covered yard, then every day or two scatter the material over the manure and mix it right in. That is especially good for rock phosphate. If you put rock phosphate in the manure stable as the manure is being made, or in the covered yard, and keep sprinkling it over every day or two, you know about how much manure is being made, and you can tell about how much to put on. The phosphate is mixed with it, and as it begins to ferment it attacks the rock phosphate, and by the time you put it on the land you have a good composition with more or less phosphorus available for the crop. Of course you can put a little with the manure in the manure spreader and spread it with the manure spreader, but I think that is an expensive way, because a manure spreader is a heavy machine. You can use some of those low down agitator feed seeders, or you can use some of the strong endgate seeders, but they are not strong enough to be satisfactory, and you are liable to break the machine with limestone or rock phosphate. They will sow bone meal and also potassium salts where we need potassium. The most satisfactory machine that I know of, and I have hunted a good deal, is one that I am using on my farm, and, so far as I know, it gives good satisfaction generally. That is the Stevens Fertilizer Sower, made to sow lime, ashes, and everything of that sort. But the one objection I have to that, however, is that it costs too much. It costs $40.00, and I do not see why it ought to cost any more than an agitator feed seeder that we buy here for $16.00. In Ohio the farmers are making their own machines; they take a pair of mower wheels and cut the axles off about three or four inches from the hubs, and have the blacksmith put in a heavy rod to connect the wheels, and put in a box between, large enough to carry a thousand pounds, perhaps, and put a double bottom in the box of sheet iron, providing both bottoms with holes, and have the lower sheet so that it slides endways, and have a lever to it so that when you pull it one way the holes match, and pull it the other, the holes are closed. They say it costs about $15.00, aside from the old mower wheels, and that it is very satisfactory. A machine made on that principle that will sow anywhere from three hundred pounds up to three tons of rock phosphate or ground limestone, you can run over your clover during the summer, and spread it on the pastures and plow it under when you get ready.

A Delegate—Why do you use the steamed bone meal instead of the raw?

Professor Hopkins—I want to show you some data in regard to that which will make the matter plainer. The steamed bone meal is cheaper. There is raw bone meal, and it has 180 pounds of phosphorus to the ton, and eighty pounds of nitrogen. If you buy that raw bone meal, you buy eighty pounds of nitrogen, and pay 15 cents a pound for it. But the steamed bone meal has 250 pounds of phosphorus and only twenty pounds of nitrogen; and we usually get the steamed bone meal about $2.00 a ton cheaper than the raw bone meal.

But our time is now up, and we will have to close for this morning.

CLASS IN DAIRYING—OPERA HOUSE.

Director Joseph Newman, Elgin, Superintendent of Class.
Prof. A. J. Glover, Fort Atkinson, Wis., Instructor.

JOSEPH NEWMAN.

TUESDAY AFTERNOON.

[From the Joliet Republican].

The dairy class conducted by Joseph Newman, of Elgin, and A. J. Glover, assistant editor of Hoard's Dairyman, Fort Atkinson, Wis., was one of the strong features of the day's work in the institute.

TESTS OF MILCH COWS.

After a brief statement of the grounds on which the dairy business now stands, Mr. Newman introduced Mr. Glover, who then turned his attention to the presentation of some statistical references relating to the subject. He confined his remarks closely to the matter contained in a pamphlet issued by the State University Agricultural Experiment Station as gotten up by himself from tests made with a number of herds of milch cows.

The increase in care of and in the balanced ration fed to the dairy stock was shown by him to have a very material and beneficial effect on the commercial value of the cow, as well as to make dairying more profitable. He gave as examples ten herds with which exhaustive tests were made, the result of each test at the end of one year and also at the end of the second year.

After the address Mr. Glover invited the delegates to ask questions regarding the work. Many of the farmers availed themselves of the opportunity and a very profitable discussion was the result. Many points that a farmer could and could not do with his limited means were illustrated. Things supposed to be out of the reach of the small farmer and dairyman were shown to not only be practicable, but of considerable importance to him.

Mr. Mason—In Illinois, is not more money lost in the lack of proper care and feeding than there is in the breeding of the cow?

Mr. Glover—I think there is; yes, sir.

A Delegate—Do you mean to say that everybody in Jefferson county, Wis., is weighing the product of each cow?

Mr. Glover—Not everybody, but many of their breeders are weighing and testing each cow's milk.

A Delegate—Do they weigh every day?

Mr. Glover—Some of them weigh every day and some of them test every month. Some of them weigh and sample every seventh week and then estimate their yearly products.

A Delegate—What would you think of weighing every tenth day?

Mr. Glover—That would give a very good result. By weighing every day you can watch the variations of your herd a little more closely than when you way every tenth day. You will note little things that may be overcome that you would not if you did not weigh every day.

A Delegate—I would like to ask you what a good ration for a dairy cow is?

Mr. Glover—Can you tell me what feed you have on your farm?

A Delegate—I have cow peas and crushed corn, good cow pea hay rich in cow peas, well cured, and crushed corn and cob. I have that on my farm. What kind of a ration will it be and how much is a ration?

Mr. Glover—I should not want to feed just cow peas and corn to my cows, although they would make nearly a balanced ration, it would lack variety. You should add some bran. How much milk are your cows giving?

A Delegate—A considerable flow of milk, more than ever before.

Mr. Glover—Are they producing, on the average, a pound of butter per day?

Delegate—I am not making any test, but my wife opened the cupboard when I started and showed she had the shelves pretty well filled with butter.

Mr. Glover—I would suggest the following ration: For a cow weighing 1,000 pounds and producing a pound of butter fat a day, four pounds of bran, three pounds of corn and cob meal—I believe you have corn stover you would like to get rid of?

Delegate—Some corn stover, but not much in the barn. I have pea hay with a little crab grass in it. Pea hay and crushed corn is what they have been eating for the last four weeks and they have done exceedingly well.

Mr. Glover—They will do well for a time, but I would rather add four pounds of bran, or two pounds of bran and one pound of buffalo gluten feed.

Delegate—Three or four weeks ago I was feeding bran and I dropped the bran out and I can not see very much difference.

Mr. Glover—We cannot always notice a change immediately after a change of feed, but let me finish that ration: For a cow producing a pound of butter fat a day and weighing 1,000 pounds, four pounds of bran, three pounds of corn and cob meal, one pound of oil meal and all of the pea hay and corn stover she will eat up clean. Now, coming back to the question of dropping out feed, A cow will sometimes draw upon her system for protein. As you will hear when Professor Haecker comes. He has been feeding cows on a very wide ration for four years and they seemingly got along on that wide ration just as well as the cows that were fed on a narrow one until this winter and every one of the cows that were fed on the wide ration, which means, containing but little protein and lots of carbohydrates, is very poor, so poor that the bones show through the hides very plainly and he says, "It makes my heart ache to continue that treatment." It has taken four years to demonstrate that a cow must have a certain amount of protein to do normal work and to keep herself in healthy condition. You must carefully nourish the cow's body because she is growing a fœtus and that is largely protein. The strength of the coming progeny depends somewhat upon the character of the food you give the cow now. You can not always tell immediately whether good or bad results will come from dropping a certain kind of feed.

A Delegate—Did you mean that the corn fodder that he has should be fed with the cow peas?

Mr. Glover—Yes; feed all of the corn stover that will be consumed without waste.

A Delegate—Wouldn't it be a very narrow ration if he left out the stover and fed only the cow peas?

Mr. Glover—It would be rather narrow. I mentioned bran for the effect it would have on the cow's digestive organs. Oil meal will have more or less the same effect.

A Delegate—If you have a cow that will test 3 per cent, can you make a 4 per cent test from her?

Mr. Glover—No; you can not. She is a 3 per cent cow. When a man discovers a means to do that with a cow, he will be a very wealthy man, because the Holstein people are looking for a man who can make their cows, which give a large flow of milk, test equal to Jerseys. Or, in other words, they would like to have the Holstein cows, with their large flow, give Jersey milk. I will ask another question: How would you feed a Holstein cow to make a Jersey of her?

A Delegate—What benefit is the cob meal to a dairy cow or any other cow?

Mr. Glover—The cob meal has but little food value. Its analysis is very low, but a cow's stomach wants bulky food. The cob meal helps to make the ration more bulky.

A Delegate—Wouldn't chopped oat straw be more beneficial to the cow than the cob meal?

Mr. Glover—Perhaps; but you have the corn cob and they seem to get a little better results when the cob meal is mixed with the corn than when it is fed alone. But to make it still better, you can chop some clover hay and mix it with the grain, or timothy hay if you have not the clover. The corn meal should be mixed with something to lighten it and to make it more bulky. I know of men who have fed large quantities of corn and their cows seem to be in good condition. I could attribute this to no other thing, but that they mixed their corn meal or corn chop with cut second growth timothy.

A Delegate—Is cotton seed meal a good feed?

Mr. Glover—Yes; it is a good feed. It should not be fed in quantities of more than two pounds per cow.

A Delegate—What feed has the most protein?

Mr. Glover—Cotton seed meal, I think. If you have plenty of carbo-hydrates, the protein that is contained in the ration should govern largely the purchasing of your feeds.

A Delegate—How about tankage?

Mr. Glover—That is hardly considered a cow feed. Dried blood is given to calves in tablespoonfuls, which is very good. We feed it to ours.

A Delegate—Gluten feed is high in protein, isn't it?

Mr. Glover—It averages about 20 per cent digestible protein.

A Delegate—Can you feed two pounds of cotton seed meal to a cow per day, while giving milk, without any injurious effect?

Mr. Glover—Yes. I might qualify this answer. There was an inquiry came, the other day, to the office, stating that a man was feeding two pounds a day of cotton seed meal, and his cows were very much constipated. I suggested that he change that to one pound of the oil meal a day, and write stating results. I have not heard from him. It is apt to be a little binding, at least it has been so reported in a few cases, but I think you can feed it without injury in amounts of two pounds.

A Delegate—Do you think it advisable to feed bran instead of corn meal and oats ground together?

Mr. Glover—That would depend on the price of oats. A pound of oats is equal to a pound of bran for feeding dairy cows. If it is just as cheap and you have the oats, I would not bother to buy bran. You can always substitute one for the other, depending on their price.

A Delegate—Isn't oats considered a balanced ration alone?

Mr. Glover—Yes, sir. So is clover hay.

A Delegate—Can you feed fat into a cow's milk?

Mr. Glover—No. Sometimes you notice an increase when a cow has been properly fed.

A Delegate—Why is it, when you haul your milk to a creamery, that one week your milk will test away up, and the next week, may be, it will go down, with the same care and the same feed?

Mr. Glover—Sometimes cows will vary considerably in per cent of fat and we cannot account for it. Sometimes mistakes are made in testing the milk.

A Delegate—I think that a cow that is fed on good feed will give more butter fat than a cow that is fed on a sand bank.

Mr. Glover—That is true, but she won't test higher She will give more butter fat because she will give more milk. I have noticed that in places where the farmers took good care of their cows, fed them well and kept them in warm barns, the test was not as high as the ones that fed their cows as you say, on sand banks, but the cows gave more milk. I have seen cow-keepers who have owned twenty-eight cows come to the creamery with two cans of milk, and I have seen dairymen who have owned twenty-eight cows come to the creamery with fourteen cans of milk.

A Delegate—This gentleman that you spoke of, that is not satisfied with less than 400 pounds of butter per cow, up there in your country; what particular breed has he?

Mr. Glover—He happens to have Jerseys, and we have another man with Holsteins doing the same thing.

A Delegate—You speak about your yearly test. What stock association has a complete yearly test?

Mr. Glover—I think the Guernsey Association. They send men once a month to the farms, not notifying the farmers when the testers are coming.

A Delegate—What breed of cattle gives the largest percentage of butter fat per week of any breed we have in the business, according to the records?

Mr. Glover—In recent years, the Holstein men have been doing more of the weekly work than any other breed. The Jersey association have refused to use the Babcock test, but they are coming to it and the associations, I think, will begin to take the Babcock test as a means of making records.

A Delegate—When is the best time for watering, before or after milking?

Mr. Glover—I think, after milking in the morning and before milking in the evening. Then give warm water—water heated to, say 60 degrees. Water twice a day.

A Delegate—Does the size of the animal have anything to do with the feed ration?

Mr. Glover—Yes sir. The larger the cow the more feed she takes to support her body.

A Delegate—I would like to ask what would you add to corn stover, ground corn and oats, to balance the ration for a dairy cow?

Mr. Glover—How much milk is she giving?

A Delegate—Oh, I don't know.

Mr. Glover—If your cows are averaging a pound of butter fat a day, you should give about four pounds of corn in cob meal, three pounds of bran, one pound of oil meal and all of the roughage they will consume without waste, and you have just enough protein to make a ration for a cow weighing a thousand pounds and giving one pound of butter fat a day.

A Delegate—Should the oats be ground when you put oats in place of bran?

Mr. Glover—Yes, for a dairy cow. For calves, feed them whole.

A Delegate—What kind of a ration would this make: Silo feed about fifty pounds; corn meal and hay or corn fodder?

Mr. Glover—What kind of hay?

A Delegate—Why, timothy hay or corn fodder and corn meal.

Mr. Glover—The ration would materially lack in protein. You have nowhere near enough protein for a cow to give a large flow of milk. She might do well for a while on that ration. You have considerable meat making material in the way of corn and by giving her some stover it will keep up a good flow for quite a while but she will not hold up on that ration through her milking period

If she is a heavy milking cow, she should have some bran or gluten feed or oil meal or cotton seed meal to give the ration a larger percentage of protein. You would not have in that ration, over a pound and a half of protein and that is just about enough, on the average, to make fifteen pounds, four per cent milk. You may make more than that, because your cow will draw upon her system. I do not wish to be understood as saying that she will not make more than fifteen pounds of milk. She may for a while, but she will not keep it up year after year.

The Chairman—We will have to call this to a close for this afternoon. It is about 5:00 o'clock. You taxpayers have to pay the bill for doing this work in Illinois. Mr. Glover has left us and gone to Wisconsin, recently. What Jefferson county, Wisconsin, has done, Illinois can do and we will ask for appropriations each year, to keep this experimental work going by sending men to your farms and demonstrating this to you at home. I believe it is more satisfactory than to do it all at the experiment station.

We have over a million cows in Illinois, according to the census of 1900. They only returned us $29.00 a cow—about 150 pounds of butter. If we can bring them up to the Jefferson county standard, we will bring into our State millions of dollars every year. That seems a stupendious lot of money, but if you figure it out, it is a fact. It will be nearly all profit. You are now receiving $29.00 per cow per year and it costs nearly that to keep her.

NOTE.—The editor was unable to secure a report of the work of the Dairy Class for Wednesday afternoon.

THURSDAY AFTERNOON.

At 4:00 p. m. Thursday, Feb. 23, 1905, the Illinois Farmers' Institute convened at the Joliet opera house, in a dairy class, with Mr. Joseph Newman, superintendent, acting as chairman, and Mr. A. J. Glover, associate editor Hoard's Dairyman, Fort Atkinson, Wis., acting as instructor.

The Chairman—The gentleman who will talk to you this afternoon in regard to the dairy farm, will show you, in addition, how milk is separated and tested, right here on the stage, inside of thirty minutes. You will see the cow milked. You will also see the cream taken from that milk, and see how it is done in a practical way. We propose to give you a practical demonstration. The gentleman who will have charge of that is Mr. A. J. Glover, who is associate editor of Hoard's Dairyman. He was last year with us as one of the field workers for our own university. Mr. Glover. [Applause.]

MR. PRESIDENT, LADIES AND GENTLEMEN—I presume this is the first time in the history of the Farmers' Institute of Illinois that you ever had live specimens at your meetings to be judged and compared. You have seen pictures that have been painted, photographs and other productions, but today we are here to present to you living specimens of dairy cows that have been bred for generations for dairy purposes. The question so often arises, is there any difference between the dairy cow and the beef animal or dual purpose animal, and if so, what is that difference?

In the beginning, undoubtedly all cattle were of the same stock, springing from one common ancestry. But by generations of breeding and by milking and choosing them for that particular thing, the dairy cow has developed into a class that has a type of its own. And what is that type? That is what we wish to discuss this afternoon. Now, we have two different breeds before us. We have on this side two Jersey cows that have been kindly brought here by Mr. Higginbotham, (or by Mr. Story, who is the manager of Mr. Higginbotham's farm), out of courtesy to the farmers of the State. On the other side is a Holstein animal owned by Mr. Graham, who likewise has taken the trouble to load her into his wagon and bring her here this afternoon that you may study these animals. One other variety, a Red Poll, will be here later. I am sorry that we have not all the breeds, but because the others are not here it is not any evidence that they are of no use. These seemed to be the handiest and they seemed to be trained for this occasion; therefore we have these animals here this afternoon.

A. J. GLOVER.

You saw the pictures that were exhibited here yesterday by Mr. Grout. You noticed their long and rectangular forms and width of back and their large fore and hind quarters. The function of that kind of cattle is to make meat. There is a catechism that was originated by General Burchard, associate editor of Hoard's Dairyman, that he called a shorter catechism for the breeder. In substance it is as follows:

Q. How many classes of cows are there?

A. There are three.

Q. What are they?

A. Dairy cows, combination cows and beef cows.

Q. What is a dairy cow?

A. A dairy cow is an individual that consumes feed and then transforms it into milk after taking out enough to support her body.

Q. What is a beef cow?

A. A beef cow is a cow that eats the grain of your farm and converts it into beef. A combination cow is "one that tries to take both forks of the road and never gets anywhere." [Laughter and applause].

Q. And what makes the difference?

A. Heredity.

Q. What is heredity?

A. It is a bibological law by which all living beings tend to repeat themselves in their descendants.

WILL COUNTY
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Now this little catechism is neither new nor peculiar and it is not my fault that it is not. If a dairyman hears that John Smith, living in a certain township of Will county, has a certain sort of seed oats that will yield ten bushels more per acre than his, straightway he will go to John Smith's place for seed oats.

Is that wisdom or foolishness?

Wisdom. Most certainly. Then why is it that when he hears of a dairyman that has a certain breed of cattle that is producing more than his that he does not seek some of that dairy blood? Why not study the art of dairying enough to know how to handle and care and feed intelligently, the dairy cow.

Now we will consider just for a moment, this Jersey heifer, which we will have led out here where we can see her. There is a heifer a little over three years old. You will note the conformation of that cow as compared with the beef cattle whose pictures you saw yesterday. There is a wonderful difference. She has not that broad back. She has not that thick heavy thigh and shoulder. She has a long body and when she gets older it will be a great deal deeper than it is now. Some of you will say that she lacks depth of body. But mind you, she is a heifer yet. She has not that development that she will have as she grows older.

Let's consider, briefly, a few points about the dairy cow. If you want to select a dairy cow, the first thing you should look at is her head. See that she has an intelligent head. And what is there about the head that shows intelligence? We want her with a broad forehead, prominent eyes—not too open, not too quick; her movements not nervous. We say we want a highly developed nervous system. We mean an animal that is full of nerves, because the nerves control all the different organs of the body. Therefore we look at the head for the intelligence and to the eye for the nerve and force power. You cannot see that cow's eye, sitting at the distance that you are, but you see that she is not particularly nervous, yet I presume that this is the first time she has ever appeared before an audience. I doubt whether any of you would be as contented, and as docile and as easy before an audience for the first time as this cow is. It shows that a cow with a kindly developed nervous system is not necessarily a nervous animal, but we expect her to be intelligent.

We also look for a wide muzzle. A wide muzzle indicates that there is a big place back of it to be filled up with food, and since it is a dairy cow's function to take the feed from the farm and convert it into milk, we want that large centerpiece. There is no other part of the body that has the power of digesting and assimilating the feed except the digestive organs. That is their function. Here we have that large mouth, which indicates there is a large opening to be filled.

We come to the udder. The udder is the only place in the body in which milk is secreted and it is secreted directly from the blood. The food is taken up by the blood and carried back to the udder through the arteries and those arteries run back and form what is called the escutcheon. Some people, in years gone by, laid great stress upon the escutcheon. There is an animal but three years old, yet I want you to note that finely developed udder with four well developed quarters. Notice also, how it projects behind.

A delegate—Was the last calf her first or second?

Mr. Story—Second calf.

Mr. Glover—You can see there, four good sized and conveniently placed teats, which is an important thing in selecting a cow. We want something we can get hold of to milk. For a heifer, it is a most magnificent type of udder and she will make a very fine cow.

I happen to know her sire and I want to speak just a moment of the prepotency of that animal. He has a head exactly like the head of that cow. It is remarkable how he stamps his likeness upon his progeny. It shows that he is a prepotent animal. That is a very important thing in selecting a dairy sire. Get one that is prepotent—one that is capable of transmitting himself to his own progeny. This heifer certainly has his head.

To hasten matters. We cannot spend too much time upon one cow. This animal will be milked now and then we want to note the condition of that cow's udder after she is milked. We are going to milk her and weigh the milk, test it, separate it, and I don't know, if we have time, we may make it into butter.

A Delegate—It would be well enough to give that cow's record, if she has one.

Mr. Glover—Mr. Story says that they don't make records of their imported cows. By that, he means a weekly record where they put them in a test and force them for a week.

Mr. Story—I might state that at the present time this old cow is giving about forty-two pounds of milk a day and the little cow is giving thirty-one.

Mr. Glover—They keep track of the milk and fat, as I understand for a year. We have here a matured cow from the same herd. I want you to note the difference between the matured cow and the heifer. This cow is a developed animal and a very fine specimen of the highly developed dairy cow. Whether that form is found in the common native, whether she is found in the Holstein, or short-horn—no matter where you get that type, invariably you will get a good performance. It is the form that counts and it is developed through years of selecting and milking and in no other way. I presume if you wanted to start out with that animal and select her progeny for years, for beef, we might be able to establish a beef breed, but it could not be accomplished in your time or mine. She has been bred for generations for dairy purposes; therefore she takes on that formation. She cannot help it, because she is built that way. She has a head that is a different shape from that of the other cow. She has not, perhaps, quite as typical a head, but nevertheless it shows intelligence. She has a good eye. She has not quite as prominent an eye as the other cow. If you were up here as close as I, you could see immediately the difference between the nervous temperment of those two cows. You can note that she has a very wide muzzle, indicating that she has large digestive organs. Notice the difference in the depth of body between this cow and the heifer. Undoubtedly she is older. You note also that this cow is very nearly straight on the back, showing that she had strength enough to carry that heavy middle piece. She is a little bit down, but you will find that in a great many cows. On account of the heavy load they carry, invariably they will begin to sag a little as they advance in years. That is no objection to the dairy cow. You notice that the young heifer is practically straight on the back. We want to look to that and not allow them to become too sway backed. A great many of our best dairy animals do tend to become sway backed.

Another thing we should consider is the rib. The distance between the hip bone and the first rib should be great. There should be large spaces between the ribs. The vetebrae should be wide apart, giving opportunity for the nerves to go out to the different parts of the body. The general conformation of the dairy cow is spare and angular. She tends to become that way. She tends to be loose. She is not a compact animal, as the beef cow is. She is entirely opposite in that respect.

I want to get a rear view of this animal. Notice the well developed udder. Notice the distance it extends up between the hind legs. It is attached well up. It is not a pendant udder. It is not an udder that is getting into the mud, as is so many cow's udders which are no larger but drop down lower. Note that she has a very large udder, showing that she is capable of handling a good deal of feed, or taking care of the feed after it has been digested and assimilated. Underneath these cows you will find a system of veins returning from the udder, going back underneath the abdomen and entering the body again. The size of those veins indicate that the udder has been supplied with a large amount of blood, and it is from the blood that the milk is made.

Are there any questions that you would like to ask?

A Delegate—Isn't one of those Jerseys an imported one and the other home-bred?

Mr. Glover—No. They are both imported animals.

A Delegate—What is the meaning of "wedge-shaped?"

Mr. Glover—If you are looking at that cow, you will notice that her sides project out and go in again, and if you look underneath, you will also find the wedge shape. We say that the dairy animal should be wedge-shaped, and that is what we mean by it.

A Delegate—When were the cows milked?

Mr. Story—This morning at the regular time—about 5:30.

Mr. Glover—We will now examine the Holstein cow.

A Delegate—How long has that cow been milked?

Mr. Story—Since the 17th day of December, and she is still giving over forty pounds of milk a day.

Mr. Ross—From where were these cows imported?

Mr. Story—From the Island of Jersey.

Mr. Glover—That island is only 7x13 miles, so we haven't very much land to choose from.

Mr. Story—I might add that these animals, for the reason that they are imported, are not our best animals. They happened to be in condition to bring today, and a little bit more easy to handle on the stage. But some of the best animals we have are native cattle, born and bred here for many generations.

A Delegate—I have heard it stated that the system of registration on the Island of Jersey was based upon performance record?

Mr. Glover—Yes, sir. It is based upon performance, because they do not allow any other breed of cattle on the Island of Jersey, and a cow must make a certain amount of butter during the year before she is eligible for registry.

A Delegate—Is that heifer a daughter of Flying Fox?

Mr. Story—No. She is by King of Arden, our herd bull.

A Delegate—Is there any place in our country where Jerseys are not allowed to be bred?

Mr. Glover—I don't know of any.

A Delegate—I understand that in the west, where they are raising cattle for beef, they are not allowed upon the range at all.

Mr. Glover—It might be, as far as beef is concerned. They are not beef animals, and they ought not to be there. They have no more business in the beef class than the beef animal has to be in the dairy class.

A Delegate—Is the oldest cow a daughter of Golden Lad? I wish you would give the breeding of those cattle.

Mr. Story—She is a daughter of Golden Lad, out of a daughter of Golden Lad—an inbred Golden Lad cow. She is 9 years old, and she is not in her prime. That is, she has passed her best days, but she happened to be in condition to bring here today, and being gentle and easy to handle, I brought her in preference to some of the younger and better cows. We think she has a decided dairy form, and, at least from the distance you are from her, you probably would not pick her faults.

A Delegate—You have tested her?

Mr. Story—We never test our imported cows, for reasons known to Jersey breeders.

A Delegate—I would like to ask one question: Do you consider that the Jerseys are the best milkers and butter makers of all the cows you know?

Mr. Glover—No; I do not. We have four distinct dairy breeds, and you will find excellent cows in all of them, and you will find scrub cows in all of them. No; they are not the only breed. They are a good dairy breed of cattle.

Now, we will consider the Holstein.

You have found that the Jersey cow comes from the Island of Jersey, a little island off the coast of England, seven by thirteen. The Guernsey cow is born there, close to her on the Island of Guernsey. These two breeds constitute what is sometimes called the Channel Isle breeds. Here we have before us a Holstein animal. The Holsteins come from Holland. They are called Holstein-Friesian. They are a cross between the Holland cattle and the cattle from Friesland. They are a cattle somewhat different from Jerseys as you will note by looking at the specimen. They are a little larger. They are a little coarser, but at the same time you see in this cow that same conformation that you do in the Jerseys. The main difference comes in the milking qualities and the difference between the Jerseys and the Holsteins is this: The Jersey does not give quite as much milk as the Holstein and it tests richer. The Holstein cow gives considerable more but it does not test so much. You have all undoubtedly heard the story of how to tell a Holstein and how to tell a Jersey? You buy a new pail; you put a bright silver dollar in the bottom of it and then milk the cow; if she fills the pail and you can still see the dollar she is a Holstein. On the other hand, if you take this same pail and put the dollar in the bottom of it, milk the cow and she does not give enough to cover the dollar, she is a Jersey. [Laughter.] That little Jersey story does show up to us, in a measure the difference between the Jersey and the Holstein cow.

You will note in that cow the spare and angular body. Good length of body. She is not now, I understand, in milk. She is dry. You will note that the Holstein animal is considerably larger than the Jersey and as a breed they are larger. As I have already stated, they give considerably more milk, but it is not so rich. The question is asked, "Which is the best breed?" That I can not tell you any more than I can tell you what wife a man ought to select. It is as the old Indian said: "If all Indians thought alike, all Indians want my squaw."

You will notice in the Holstein animal that she has a somewhat different head from that of a Jersey. She does not show that highly developed nervous temperment that the Jersey cow does.

We have had one of these Jersey animals milked. I want to call attention to this cow's udder after she has been milked out. The udder should be flabby, lie in folds, as one man says, like a leather apron. You can note that this cow's udder milks down very nicely. You see here is a lot of loose skin, so you see that the udder is entirely milked out, which shows an animal that has a very nice udder.

Mr. Story (displaying a well-filled milk pail)—Would that milk cover a dollar? [Laughter.] The heifer gave about 15¼ and this is about the same, a little more. The old cow got a little nervous getting down and she did not milk as much as she does at home. She does not like to be moved around.

Mr. Glover—We want to note the Holstein cow. She is dry, understand, but we want to note that she has a large udder. I do not suppose that you can see from that distance that cow's udder, but she has four large and well placed teats. She has just started to spring a little bit now, so her udder does not show up quite as well as it would if she was just milked because it has started to fill up. The Holsteins are not so susceptible to disturbances as are the Jerseys. The Jersey is disturbed when you take her from her stall and change milkers, while the Holstein pays but little if any attention to who milks her or what stall she is in so long as she gets enough to eat. She is not easily angered, but when she is, I don't know of any other dairy breed of cattle that get so angry as the Holstein.

We have here this afternoon, as I understand it, a dual purpose cow that is supposed to produce heifers that are good milkers, and to produce steers that are valuable for beef. She is named "Davy Bell 2d" and was bred by G. W. Coleman, of Webster City, Iowa, and is owned by James Kestel, of Manhattan, Illinois. She is a Red Poll and had a calf the second of August. She is supposed, as I said, to be a representative of a dual purpose breed. You will notice, about that cow's udder, while it is fairly good, the teats are not well placed. You will sometimes find the same thing in the dairy cows, mind you, as to that. But it is an objection. We should look to getting the udder square and having, as I said before, the teats large and well placed. You will note that this cow carries more flesh. She is, however, more of a dairy animal than a beef animal and I think, if she was put in the beef class to be judged, she would not rate very high. She would be classed as a dairy cow. In some families of the Red Poll you will find them more beefy. Some judges, when in the show ring, you will find, judge from the dairy standpoint and others from the beef standpoint. I am unable to solve the question as to how we are going to treat a class of cattle that will make good beef and milk in any large quantities. I do not deny but what the Red Poll will give you a great many good cows, but we are talking dairy cows particularly this afternoon and their conformation. So far, no one has ever demonstrated that it is profitable to breed a dual purpose breed and it is left to the Red Poll men to solve this question for us. But here is a very nice looking animal and I should expect she would give very good returns for the feed consumed.

Now, we are going to test the milk and we will have to change the subject a little to that of the Babcock test. We take 17-6 cubic centimeters of milk and put it in this little bottle, which has a graduated neck. This neck is divided into ten parts and each one of those parts into five spaces. If we have a column of fat running from zero to ten, we have a cow that is producing ten pounds of butter fat in every 100 pounds of milk If it runs from zero to five she tests five per cent or five pounds of butter fat in every 100 pounds of milk. If it runs from zero to 3-2, it means that there is 3-2 pounds of butter fat in every 100 pounds of milk.

In sampling this milk, I must be careful to take it from a portion that has been thoroughly mixed and then measure it exactly. It will be about ten minutes before we will be able to give you the result of this test. I do not wish to take issue with anything a certain professor has said in regard to our children being more important than cows, however, I do not want my friends to forget that the cow in these days is the foster mother to thousands of babies in this country. The cow is a noble mother. [Laughter and applause.]

We will test this cow's milk. I have in my left hand sulphuric acid composed of two parts hydrogen, one part sulphur and four parts oxygen. It makes an acid that we call sometimes the king of acids. If you put a drop upon your clothing it will eat it up immediately and you would be very likely to feel its effects upon the skin and flesh beneath. We take 17-6 cubic centimeters of the acid and pour it into the test bottle and mix the acid and the milk. Note that I turn the bottle as I pour the acid in; that is to rinse the milk all down from the neck of the bottle to make the test accurate. The sulphuric acid disolves the milk. As I shake the bottle you will notice that the white substance soon disappears. It has dissolved the casein and turned it into a new compound. I would like to pass that bottle around and let you note how hot it has become. A chemical change has taken place. The sulphuric acid dissolves the white substance in the milk, thereby liberating the fat. The fat is now more or less liberated in there. But in order to get it to come to the top, we put it into the machine and whirl these bottles at the rate of about 1,000 revolutions a minute.

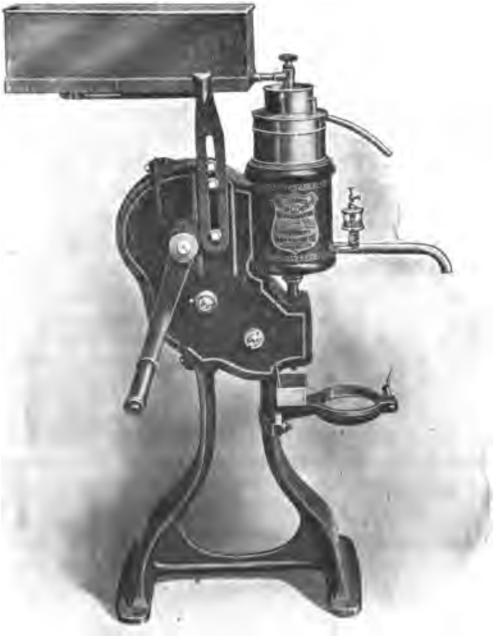
While that test is being turned, I want you to note the difference in the conformation of those two animals simply by looking at them and observing the difference. It is better than any word picture that I could possibly paint. Note the heavy thighs of the Red Poll cow; the heavy hind quarters. They claim that she is capable of producing considerable beef, and she is. Compare her quarters with those of the Jersey. The dairy cow does not need a heavy hind quarter because she does not put any of that into milk, it just means that much more to support. But if you are going to raise beef it is necessary to have a cow with heavy quarters. If you can notice, and I think you can, the difference in their backs, you will see the red cow has a wider back—much wider than the Jersey. You will notice that her middle piece is covered with more flesh; that the Jersey is more spare and more angular in every way. She has a deeper body. Look at that paunch on the little cow as compared with the digestive organs of this Red Poll cow, which is supposed to perform two duties—making beef and making milk. But you can see that in the very nature of things, that that animal is handicapped in the making of the same amount of butter that the Jersey cow is because she does have two functions to perform.

It is pretty hard to talk against a machine like that (the tester) and if you have any questions to ask I would be very pleased to answer them.

A Delegate—How about the Guernsey cow?

Mr. Glover—The Guernsey cow is very much like the Jersey. She is a little larger cow. She comes from the Island of Guernsey, which is not far from the Island of Jersey. The two breeds together are called the Channel Islands cattle.

Some one asks, are the Guernseys not stronger in constitution than the Jerseys? I can not say that they are.



Notice, now, on my left and on your right, the cream separator. The skimmed milk is coming out of the large tube that you see there immediately above the creamery can and the liquid running into the pail is the cream.

The milk has ben milked before you and now we are separating the cream almost immediately after it is milked. It shows how quickly we can raise the cream.

Question—How much milk did the red cow give—how many pounds?

Mr. Glover—She gave seven and three-quarter pounds. She dropped her calf August 2, and she was milked this morning, Now, I want to say, on behalf of all these cows that it is no measure of their value, the amount of milk that any of them produce at the present time; it is no measure of their capacity, because the cow might be ever so valuable, and, under the circumstances, might produce only a little milk. One might have been milked much later in the morning. In order to get at what a cow is doing, we must weigh and test the milk for a year, not only daily, but five or six tests a week during the fifty-two weeks of the year.

I want to call your attention to how contented this cow is—the Jersey heifer. She is chewing her cud here at this very moment, showing that she is not disturbed very much by this audience—not concerned about what is going on about her.

Mr. Story says that the old cow is off considerably in the amount of milk she gave, but this heifer does not show any change. I mention this simply to show you the things we should consider when we are breeding a dairy herd of cows. For the young boy, just starting out, think of the opportunities there are for him to study since we know so little of the things that may disturb and affect our dairy animals.

We will proceed to show you the balance of the operation in the Babcock test, although we have not the facilities exactly as we would like them. This water is not warm enough; 120 to 130 degrees is about the right temperature. If it is too cold, it contracts the fat and you do not get the proper reading, Now you will notice as I pour this hot water into the bottle, that the fat flows up into the neck of the bottle. I wish we could have water warm in order to give the cow a fair deal. Now, the bottles are placed back in the machine and we will whirl them one minute more and then we will tell you what the Jerseys test. The first time it was turned five minutes.

Question—Isn't there sometimes something that comes up into the neck of the bottle and prevents an accurate test?

Mr. Glover—If the acid is too strong or too weak, in either case we can not get an accurate reading.

Now here we have it. We have the test of these cows. The old cow tests about 5.8 per cent. It is impossible to read that accurately, I will admit, because it is too cold. It ought to be warmer. The milk from the heifer tests in the neighborhood of 5.8 per cent. Perhaps if either of the test bottles was warmed up it would show considerably more. But either of these cows tests in the neighborhood of 6 per cent.

A Delegate—Don't you suppose those cows would have tested better yesterday than today, after being brought up here on the stage?

Mr. Glover—Undoubtedly. I would like to pass these tests among you if some of you would like to examine them.

A Delegate—Is that about their usual test at home?

Mr. Story—No. I think the little cow can test considerably more under favorable circumstances. I doubt if you could get a correct test under these circumstances.

Mr. Glover—We simply did this to show you the process of the testing and not for anything else. The Red Poll's owner tells me her test averages about 4 per cent. She has tested 3.8, 4 and 4.2. That means much more that if we would test her milk here this afternoon.

AGRICULTURE IN THE SCHOOLS.

In July, 1905, the Superintendent of Farmers' Institutes sent the following letter to county superintendents of schools:

Superintendent.............................

....

DEAR SIR—Will you kindly furnish me, so that I may have it not later than August 3d, a brief report of the work being done in the schools of your county in the elements of agricultural science? I want this for publication in the Farmers' Institute report, Volume X, to be printed immediately.

I should like to print the report over your own signature.

If you have already sent me printed matter relating to this subject, I may, with your permission, publish extracts from it in addition to the personal report for which I ask.

I realize that I have no claim on your time and strength; and if you cannot favor me with the information desired I shall not regard it as a discourtesy. However, for the sake of the cause, I should like the facts for publication.

Very truly yours,

FRANK H. HALL,

Superintendent-Secretary.

The information thus obtained, together with extracts from the printed matter referred to in the foregoing, is given herewith. It should be said that this report was requested on exceedingly short notice and during the usual vacation period. Many superintendents may have been away from their homes at the time and therefore unable to comply with the request.

ADAMS COUNTY.

QUINCY, ILL., Aug. 7, 1905.

There has been some work done in the county in the way of planting, and considerable theory along the line of agricultural science has been taught, but I am unable to give a detailed report.

A. R. SMITH,

County Superintendent of Schools.

NOTE—The serious illness of Superintendent Smith at the time the request was made for a report upon this subject, made it impossible for him to submit the details of his work—Editor.

BOND COUNTY.

GREENVILLE, ILL., July 29, 1905.

In sending out my circulars to the teachers of the county during the past two years, I have urged every teacher to do at least all the agricultural work as laid down in the State course of study. I am pleased that in almost every school the work has been intensely interesting to teachers, pupils and patrons throughout the county. In my visits to the schools the teachers, at times, have gone over the work for an hour while I was there, and I was surprised to find that children know the work so well and that they had taken such pains to look up the work.

I am pleased to say that we are succeeding with the work through the efforts of the teachers. They usually get helps from the publishing houses along this line, and most of the teachers have supplied themselves with some good work on elementary agricultural science.

In my final examinations each year, I have a list of questions based on the subject, and I feel that this is an important thing on account of its showing the teachers and pupils that we expect some work done along this line.

W. T. HARLAN,

County Superintendent of Schools.

BOONE COUNTY.

BELVIDERE, ILL., July 31, 1905.

I find it difficult to interest the teachers in a subject they know so little about. The boys and girls are eager to do all they can.

More than fifty pupils are trying the experiment of detasseling part of the corn in a field. They will make the same experiment next year, using for seed the corn raised this year. I am trying the "corn experiment" myself. I have learned something, too. I shall not be surprised if I learn even more than I now know!

I want a copy of the Farmers' Institute Report containing Mr. Orr's address on the management of poultry, for every teacher in Boone county. Congressman Fuller sends the Agricultural Year Rook to every school, and the teachers are receiving some of the bulletins from the agricultural department at Washington and from our own experiment station at Urbana.

J. G. LUCAS,
County Superintendent of Schools.

For the purpose of "suggesting and provoking thought rather than as a test of what they know" Superintendent Lucas has used the following in his teachers' examination:

AGRICULTURE.

1. Name the products of Boone county. Name the harmful weeds in Boone county.
2. Explain the method of breeding "high bred corn."
3. Name the different breeds of chickens which you know and classify them as to their particular value.
4. Define annual, perennial, parasite, biennial, bacteria.
5. Name the harmful insects of Boone county. Name the beneficial insects of Boone county.
6. What birds are harmful and why? How can alfalfa be successfully raised in our county?
7. Tell what the following words suggest to you: Pekin, Southdown, Thoroughbred, Berkshire, Durham, Marino, Clyde, Morgan.

NOTE.—The county superintendent of schools and many of the teachers attend the farmers' institute in this county.—EDITOR.

BROWN COUNTY.

MT. STERLING, ILL., July 31, 1905.

Very little work in the elements of agricultural science is being done in this county. I furnished seed corn to all the boys that applied for it last spring; so we will have a "corn contest" at the farmers' institute next December.

H. V. DAVIS,
County Superintendent of Schools.

CALHOUN COUNTY.

BATCHTOWN, ILL., July 29, 1905.

Our schools have done but little in the elements of agricultural science. We have no high school in our county and but two schools in which any higher work is done than the work outlined for eight years in the State course of study. In all the other schools nothing more is regularly done than the eight years' work or its equivalent. Our county is purely an agricultural one and the pupils of the schools come from country homes, mainly. The schools begin about Sept. 1, and close about April 1, the usual length of term being seven months. It is usually about Nov. 1, when the older boys and girls enter school which means not more than five months school for them during each term. The work outlined in the State course of study is for eight months work, and as more than two-thirds of our school follow the course as closely as is practicable, our teachers find no time to do any work in the elements of agricultural science without cutting out some of the branches now taught, and I hardly know what could be left out without serious detriment to the pupil, or to alternate the work to a degree that would be weakening and unsatisfactory to pupil, patron, and teacher.

I fully appreciate the importance of the farmer's acquiring scientific knowledge of his vocation, of the composition of soils, when rotation of crops is necessary, and what crops should follow certain other crops, the valuable qualities of certain domestic animals, the nutritive value of certain food rations, the value of drainage and how to achieve the best results therein; all these and many other things that have to do with his success as a farmer are of the highest importance to him. But I do not believe that much can be done in the schools of our county along the line of agricultural science that would be of any permanent value to the pupils.

What would you do in the matter? How would you find time for doing anything that would amount to much in the study of the elements of agricultural science under the conditions I have named? Our schools are doing the work outlined in the course of study up to, and including the eighth year, but it requires close and persistent work to do the work in the time allotted to do it in. What can we give these pupils that will do them more good than what we are giving them? I am deeply interested in the work of the schools of my county and would do anything to improve their efficiency.

If you can find the time to do so I should be glad to have any suggestions or criticisms you may care to make.

ELMORE ALLEN.
County Superintendent of Schools.

NOTE.—The foregoing is published (with the permission of Superintendent Allen) because it presents so clearly and so forcibly some of the difficulties with which one is confronted who attempts to introduce agricultural science into the schools. The editor offers no "criticisms" whatever of Superintendent Allen's work. It is not the purpose of this report to criticise the work of county superintendents or teachers; but to make apparent the obstacles in the way of introducing this subject into the schools, and to submit for the consideration of all, the tentative methods that are being employed in some counties.

With becoming modesty, the editor will offer the following "suggestions":

Perhaps, when we learn how to do it, nature study and agriculture may furnish a share of the topics which will profitably be employed in teaching the children to read, to spell, to write, and to cipher. In this way it is believed the foundation at least may be laid for scientific agricultural instruction, and the interest in this subject greatly promoted. We are hoping that the children in Calhoun county and in all the counties of Illinois may be made aware of the fact that education, equal in amount but different in kind, is as necessary for the future farmer as for the prospective physician or lawyer. Some time the course of study will be elastic enough to adapt itself to the needs of all.—EDITOR.

CASS COUNTY.

VIRGINIA, ILL., July 29, 1905.

At least fifty per cent of the country district schools in Cass county give instruction in the elements of agriculture, by use of the United States agricultural charts, or by nature study, or by special Friday afternoon exercises. In some of the schools regular classes take up the work in connection with nature study and biology.

The work as outlined in the Illinois course of study on agriculture has been adopted by most of the schools either in part or the whole.

In all the schools where agriculture is taught the pupils manifest much interest in the work.

A. E. HINNERS,
County Superintendent of Schools.

CHAMPAIGN COUNTY.

URBANA, ILL., July 27, 1905.

In the study of agriculture we have to do the work as outlined in the course of study for the common schools of Illinois.

The work has been observation and personal investigation by the pupil. Each pupil is expected to keep a record of his work. A minimum amount of text work has been done and a maximum amount of observational work.

The facts learned by the children have not been so important as cultivating the habits of studying their environments. The agricultural work is included in the monthly, central and final examinations.

CHARLES H. WATTS,
County Superintendent of Schools.

CHRISTIAN COUNTY.

TAYLORVITLE, ILL., Aug. 1, 1905.

As I attempt to write out in cold type a record of what has been done in the schools of this county with the subject of agriculture, I am confronted with the conviction that it is an impossibility, for we cannot measure the results that may come from the efforts of the earnest teachers who have entered into the work with enthusiasm and determination to succeed

The work thus far has been inspirational rather than actual although some actual work has been done. The first thing attempted was to prepare the minds of the teachers, patrons and pupils so that when the subject was introduced into the schools there would not be opposition sufficient to defeat its success.

When Superintendent Kern, of Winnebago county, sent out the circulars to advertise his first farmers' excursion to the State University and Agricultural College at Urbana, one of the circulars came to my office and it set me to thinking. I decided to try a similar excursion for I believed it would open the eyes of teachers and people generally to the possibilities for education and culture which lay in the subject of agriculture, and would do much to popularize the subject in the minds of the country people.

So the first furrow was turned when we began to agitate for an educational excursion from this county to the State University and Agriculural College. I talked with every farmer who came into my office and with the teachers whom I met from time to time and everybody to whom I mentioned the trip fell in with the idea. I wrote to Dean Davenport to ask him to suggest the best time to make the visit and he named October, so we decided to set the date for October 10 and 11.

As soon as school began in September, circulars advertising the excursion were mailed to every teacher and school director in the county and on the morning of October 10, a company of 306 men, women and children filled the six coaches of our special train at the different stations on the route. Our visit was made pleasant and profitable by the kind reception and the courtesies extended by Mr. Fred Rankin and the faculty of the Agricultural college. Nothing in the history of the schools has proven so helpful or so educative as that two days' visit at the great educational institute which is provided by the State at the expense of the taxpayers many of whom have never realized what it offers to the youth of our land.

That winter many teachers made an honest effort to follow the outlines for the study of agriculture furnished by Dean Davenport in the State Course of Study. The next summer (1903) at the teachers institute, Mr. Farr, assistant superintendent of Cook county, presented the subject to our teachers and he gave them many excellent ideas for presenting it so as to win the interest of the children and the support of the patrons. Mr. Farr also gave an evening lecture, illustrated with stereopticon views, on the subject "The Home, the Farm and the School."

In order to bring out the directors, postal invitations were furnished to every teacher who signed his name to three of them and sent them to the directors of the school where he was to teach the next winter. As a result many directors were in attendance and they went away enthusiastic over the prospect of having teachers who were interested in their home life as well as in drawing their pay.

When schools began in September the teachers were asked to have pupils prepare an exhibit of some of their work in agriculture during the fall months and to bring it to the Thanksgiving meeting, and as a result there came from all over the county collections of seeds, charts giving crop reports, scrapbooks containing pictures of the different farm animals, and weather reports. Not a great variety nor anything remarkable to the casual onlooker but to me it meant an honest effort on the part of teachers and pupils to do their part in starting the new work.

At this same meeting Mr. W. B. Otwell who has made his name a household word in so many homes of the State by gathering together the exhibit of corn made by the 8,000 farmer boys of Illinois at the Louisiana Purchase exposition, addressed the teachers and farmers on the "Value of Agriculture in the Schools" and did much to convince the people that we are on the right track.

Again in 1904 the subject was presented in the summer institute and a book was recommended which would guide the teacher in the study of soil, plant growth, drainage, etc., and which could be used to unify the work in order that the subject could be made a part of the final examination test. Boys and girls, too, purchased the book and set to work to study as they never had before. The book, which was recommended as one of the Pupils' Reading Circle books for 1904 and which is considered one of the best works for young people, was supplemented by the bulletins from the agricultural college and from the agricultural department at Washington, also by the leaflets published by Mr. C. M. Parker who lives in Taylorville.

Last year there were 103 boys who procured corn from Mr. Hostetter and they were organized into a club which is known as the "Christian County Corn Contest Club." Some of these boys exhibited their corn at the farmers' institute and many more were in attendance at the meeting and heard Dr. Hall's address on the subject "Business Education for the Farmer." Directors have come to realize the relation of the farmers' institute to the school and in many districts the teachers are allowed to dismiss their schools and attend the meeting, as was demonstrated there.

The corn contest club for this year numbers 175 and the corn was furnished them by two progressive farmers, Mr. W. S. Hedden, who is president of the Farmers' Institute for next year, and Mr. F. B. Kincaid, who was a prize winner on corn. The corn was distributed from my office and every effort is being made to secure an exhibit from every boy of the club this fall and the officers of the Farmers' Institute are lending their help. We hope, too, that a large number of boys will enter the corn judging contest. To that end, the work in agriculture was again presented this summer in the teachers' institute by Mr. Farr, and on Friday, the last day, the boys came in with their fathers to hear a lesson in selecting their corn for exhibit by the score card. The teachers were instructed in its use also, in order that they may be able to help the boys this fall.

In May of this year another educational excursion was undertaken, and while it was not so well attended as the first on account of the busy season, the results were really more encouraging, for, of the 150 who went, fully half were under twenty-one years of age and only five of the crowd were in the previous excursion. Since that date, May 27, many people have urged another excursion in the fall, after the busy season is over, and we are going, for Mr. Rankin has written that we will be welcome.

As a result the children are interested in the subject, and do the work because they are interested and not because they are compelled to do it. The patrons are in sympathy with the work, and give their support to it instead of hindering by adverse criticism. The teachers, too, are enthused, and are willing to inform themselves on things which are not clear to them. In some schools corn has been brought in for exhibition (this is a corn county) and prizes were awarded for the best. In one school where the teacher was very enthusiastic, all kinds of vegetables and grains were exhibited and blue and red ribbons were awarded.

Pupils and teachers have been asked to report whether they like the work or not, and one teacher wrote me that in his district the soil was very poor and the farmers were mostly renters, so that the children were not very enthusiastic on the subject as their experience led them to believe that farm life meant nothing but drudgery. Another, who farms in the summer and teaches in the winter, and whose farming is not the best in the world, wrote that his pupils simply *despised* the subject, and I am inclined to think that the children were influenced largely by his own views. But we must be patient. Let the little leaven work and in the near future the teachers will be prepared to be examined upon the subject and the law will require it to be taught, then it will receive equal recognition with the other studies of the course—with spelling and even arithmetic.

We have attempted few school gardens for reasons which would make this paper too long; but more shade and ornamental trees have been put out than for many years, and some of the yards have been made to fairly bloom with flower beds and shrubbery. The work is just fairly begun. What the results may be the future will tell, but I am glad that the start has been made, and so long as I am connected with the schools of Christian county I shall bend every energy to help prove that "The wealth of Illinois is in her soil, and her strength lies in its intelligent development."

ANNA LOIS BARBRE,
County Superintendent of Schools.

COLES COUNTY.

NOTE.—The following is from a little booklet sent out in the spring of 1905, by County Superintendent W. Ed. Millar:

To the Directors of District Schools of Coles County, Illinois:

GENTLEMEN—At the December meeting of the county board the supervisors unanimously voted the sum of $100.00 to assist in introducing the active study of agriculture and domestic arts in the public schools.

This movement is designed to establish a closer relationship between the school and home life of the pupil, and to give the boys and girls material for mental and industrial growth which may be perfectly assimilated.

The schools have a tendency to cultivate a spirit of discontent, which stimulates the desire to leave the home on the farm.

It is my earnest wish to counteract this tendency and to show the boy and girl that his home on the farm, in at least a large number of cases, may be made the best place for him.

I believe there is enough material at hand in and around the homes of the boys and girls of this county, if properly prepared and presented, to convince them that the opportunity to become useful, successful, happy men and women, lies immediately within their reach.

I do not want to lose sight of the essential elements of a common school education, but I do want to help the boys and girls to become earnest, active thinkers for themselves, and to develop in them the cardinal virtues of good citizenship, viz.: To be self-supporting, law-abiding, public-spirited, frugal-minded.

Like all movements toward a better citizenship, this must be of slow growth and the object of much solicitude. We cannot expect all of our hopes to be realized, or immediate results, but if our children's children reap from our sowing, it is enough.

I earnestly ask your hearty coöperation in this matter.

Respectfully,
W. ED. MILLAR.

Superintendent Millar invested the $100.00 mentioned in the foregoing as follows:

100 copies Agriculture for Beginners—Burkett, Stevens & Hill.
150 copies Emergency Notes—G. R. Butler.
40 copies Hapgood's School Needle-work.

He also procured "about 800 pounds of good pamphlets on subjects allied to farming, housekeeping, dairying, etc.," which he placed in the schools. Superintendent Millar went before the Coles County Agricultural Board and secured an annual appropriation of $100.00 in premiums for juvenile work. He arranges for an annual exhibit of school work at the county fair.

Last year he rented four or five acres of good land, divided it into one-fourth acre plots, and put the city boys (Charleston) at work upon it. The boys sold from $3.00 to $20.00 worth of produce each, besides carrying home a large amount of "garden stuff."

This year quite a number of boys are farming on their own account. Mr. Millar expresses the conviction that there are hundreds of boys in Illinois cities who need assistance and encouragement in doing useful things, and who lack only "an opportunity and a little genuine comradeship to make sturdy citizens of themselves."

Superintendent Millar's little booklet on the Domestic Arts in the Coles County Schools should be read by every teacher in Illinois. Its concluding page, referring to sewing in the schools, is as follows:

"The stitches may be very close in fine goods and of greater length in coarser material; in all cases the stitches should be uniform in length. Avoid drawing the thread too tight; make the seam straight. Fasten the end of the thread securely.

Things to avoid:
    Great haste.
    Coarse needle.
    Thread too long.
    Knotted thread.
    Stooping position.
    Putting needle in the mouth.
Things to practice:
    Close attention to what you are doing.
    Let the light shine on your work, and not in your eyes.
    See that your sewing materials are put away before leaving the room.
    Be painstaking and devoted to your work. Take pride in doing it well.
Things to make:
    Cheese-cloth dusters.
    Dish towels.
    Sewing bags.
    Pencil holders.
    Aprons.

Patch and darn articles of clothing brought home.

Fasten sample of each kind of work in your note-book on the left hand pages. Copy the notes you have taken on opposite side of page. Be neat and careful in your work."

W. Ed. Miller,
Superintendent of Coles County Schools.

The following prepared by Professor Otis W. Caldwell of the Eastern Illinois Normal School at Charleston, has been put into the hands of all the teachers of Coles county by Superintendent Millar.

Every district school can have a flower garden and can add greatly to the attractiveness of the grounds thereby. Old stumps, fences, out-buildings and school house walls offer locations for extended decorations. From the suggestions given selections and adaptations can be made that will help almost all our school grounds. Care should be taken to see that the ground where plantings are made is rich and well pulverized. A small amount of well-directed work will keep the plants in good condition:

1. Near the door of the school house as well as elsewhere near its walls, place young plants of Virginia creeper (Ampelopsis). This will climb upon the wall and may be trained into any position desired. It is perennial.

2. On a fence or near the building and supported by lattice work plant two or three species of Clematis. These may be grown from seed, or results may be had sooner by use of young plants.

3. At the base of one or two trees and near the wood or coal shed plant young plants of the Virginia trumpet vine (Tecoma).

4. In a bed near a fence in a well lighted place plant seeds of a number of kinds of sweet peas. As they grow they can be trained upon the fence.

5. Grow "Jupiter" nasturtiums in a place similar to that mentioned in four, and grow Chameleon nasturtiums in a bed almost anywhere about an old stump, or a rock; or by the building is a good location.

6. Plant some hollyhocks in one corner of the yard and in another plant some cosmos. Both grow well from the seed.

7. Bring into the ground and plant in as nearly normal places as possible the wild flowering plants of the vicinity not already found in the school ground.

8. In addition to the above a bed of flowering plants will prove very instructive and gratifying. Make a bed six by fifteen feet in rich soil in a place well exposed to the sunlight. Pulvervize the ground thoroughly. Plant it with reference to the plants to be used so as to form a bed symmetrically arranged. Selections from the following plants should prove desirable: Ageratum, Alyssum, Candy-tuft, Forget-me-not, Bachelor's button, Lantanna, Zinnia, Canterbury bells, Petunias, Pinks, Snap-dragon and Browallias. If it is desired to have a bed distinctly for summer and autumn blooming, a bed of cannas surrounded by umbrella plants will be found excellent.

A number of reliable houses will supply seeds and young plants. If your dealer does not have what you want, write to Vaughan's Seed Store, Chicago, for the seeds you wish, and to Peterson & Co., Chicago, for young plants.

Cook County.

Chicago, Ill., Aug. 1, 1905.

In Cook county we are introducing the Elements of Agricultural Science into the rural schools as rapidly as circumstances will permit.

During the year a number of stereopticon lectures have been given; the object of which has been to awaken an interest in the farm, the home, and the school, especially in their inter-dependent relations.

A series of "corn meetings" have also been held. At these meetings the farmers and their boys met at convenient points and the matter of better corn and more of it was discussed. Special effort was put forth to help those boys who had entered the corn growing contest. They were instructed in the selection of a corn exhibit and in the use of the score card. At our annual institute, a series of five lectures in Primary Agriculture are to be given by Prof. Fred L. Charles of the DeKalb State Normal. Dean Davenport of the University of Illinois is also to deliver an address at the same meeting along similar lines. We are alive to the importance of this subject and hope to impress our young people with the fact that the wealth of Illinois is in her soil.

A. F. Nightingale,
County Superintendent of Schools.

Crawford County.

Robinson, Ill., July 27, 1905.

The work in Elements of Agricultural Science is just beginning although much has been done in preparation.

The boys of the county, from all sections, have contested at each farmers' institute for prestige in corn growing. The schools have individually taken up *lines* of nature study best suited to their conditions. "Native woods" were studied last year, and reached up to farmers' institute in spirited contest, as shown by cuts, etc., in School News.

An enrollment of the schools which voluntary enter this new field, and names of individuals who begin the study have been taken, and soon we shall be working more logically than in the past. The one great drawback is a suitable text-book to guide in the work, and to be used as general reference.

Harry E. Green,
County Superintendent of Schools.

Note.—Many teachers and pupils attended the farmers' institute at Robinson, Dec. 1, 2, 3, 1904, and manifested much interest in the work. The exhibit of "Native Woods" was a pleasing feature of the institute.—Editor.

DEWITT COUNTY.

CLINTON, ILL., July 29, 1905.

We are following the outlines of the State Course of Study on the Elements of Agriculture, and include that important subject in our bi-monthly examinations. Also, we have our prize corn growing contest, from seed furnished by Mr. Otwell, which has resulted in past years in having quite a display of corn at the annual farmers' institute. I have used my personal influence, by circulars and otherwise, in an effort to create an interest in this science, and if possible, to reduce the theory of agriculture to a practical basis in DeWitt county.

T. C. WAMPLER,
County Superintendent of Schools.

NOTE.—The county superintendent of schools and many of the teachers of DeWitt county were present, took places on the program, and contributed in large measure to the success of the institute held in Clinton, Jan. 13 and 14, 1905.—EDITOR.

DOUGLAS COUNTY.

TUSCOLA, ILL., July 27, 1905.

Every rural school in Douglas county has been urged to conduct at least two lessons a week in agricultural science. In the central and final examinations of each spring, the county superintendent of this county gives an examination on agricultural science, and during the past two years a goodly per cent of the pupils carried this examination.

The past year there were about ten school gardens in this county that are a credit to the schools. Also two schools made a reasonably good study of the weeds of their district.

The coming year we are planning to be more successful in this same line, especially in the results from the two lessons each week.

ANNA E. ROGERS,
County Superintendent of Schools.

DU PAGE COUNTY.

WHEATON, ILL., July 29, 1905.

It has been our custom for several years to offer certain premiums at our Farmers' Institutes for work done by our public school pupils; also for collections made of the products of the different districts. We have included in these products everything that could be grown or made upon the farm and, as Brother Farr will inform you, we have had some elegant exhibits from time to time at our Farmers' Institutes. The object in introducing this line of work into our schools has been that we might interest the pupils in their environment. We have succeeded in arousing a deep interest in almost every district in the county. In visiting the schools throughout the county, I find that the children have learned many things concerning all kinds of crops, as they have grown potatoes, corn, apples, tomatoes, pop corn, sweet potatoes, squashes, cabbages, pumpkins, wheat, oats, rye and barley for these exhibits. And in fact, the wheat that has been grown upon the home place is turned into flour, and the young ladies with their mothers have not only brought in bread but all sorts of fine cooking has been represented in these exhibits of the schools in the various districts. The small fruits have received attention as well as the larger ones, such as apples and pears, so that we have had a fine exhibit, not only from the farm and garden and the orchard, but from the household and the kitchen the children have presented some elegant exhibits of jams, jellies and preserved fruits of all kinds.

Under another cover, which I forward you today, is a part of a little paper which I read before the Northern Illinois Teachers' association at Freeport, and also, by request, before the Teachers' association of this county. It illustrates somewhat our method of work, as I find many of the teachers at work along the lines of these suggestions. I do not deem this a report, but it may give you some idea of what we are trying to do in this county. Mr. Neal of Lombard, Illinois, came before our Teachers' association on the 20th of May, at Naperville, and made a beautiful address upon the subject of "Corn and Its Products;" also leaving a large number of parcels of corn to be given out to the pupils of the different schools in the county. The teachers were so much interested in the matter that almost every rural school teacher took home a bundle or two for her boys, as I had previously advertised that Mr. Neal would be on hand to supply corn from which to make exhibits and observations at our coming Farmers' Institute.

I consider the joint Teachers', Farmers' and Children's day at our Farmers' Institute as one of the best methods of inducing interest in the subject of agriculture; also of keeping that interest already awakened alive that has come under my observation.

Use anything that I have said or not, as you choose, and believe me deeply interested in the great work you are doing for the highest interest of the young man and young woman of the State of Illinois.

R. T. MORGAN,
County Superintendent of Schools.

NOTE—Nothing is more noteworthy as indicative of interest in agricultural science than the very large number of teachers and pupils that *always* attend the Du Page county Farmers' Institute.—EDITOR.

AGRICULTURE IN PUBLIC SCHOOLS.

(Methods by which it can be taught successfully by Prof. R. T. Morgan County Superintendent of Schools for Dupage County, Illinois).

Farming is nature study in the highest and most useful sense to mankind, a study that Cincinnatus and Washington both adorned with the matchless touch of their splendid genius, noble lives, and exalted manhood. It is needless to say that they were both made greater and wiser for their communion with nature's God through the study of nature in its most practical form.

I grant that a teacher must be intelligent, or at least have a teachable and inquiring mind. If she is thus equipped, she, by proper questions, will first be able to gain the attention of the pupils, next direct them in making observations, after the observation lessons will come the investigation, and investigation properly carried out will lead to methods of study on the part of pupils. The method of study once fixed in mind, they have passed from the realm of helplessness into the region of power, where they can build foundations that will lead them to success in any line of life's work.

As to the "how," let me suggest that there should be planned outlines for this agricultural work. The relation of time should form an important factor. There should be a fall period, a winter period and a spring period of study. In the fall, journeys should be made into the fields and pastures; and soils and seeds of all kinds should be collected by the children. Weed seeds of every description, wild fruits and nuts to form one collection, and cultivated grains and vegetables, to form another. If the school-house is not warm enought to keep the vegetables, some near-by farmer boy will gladly accept the office of storekeeper, and preserve such collections until they are needed for use in the late fall or winter time. Another collection of seeds for kitchen gardens and flower gardens should be made.

There are always in any neighborhood a few rare and helpful old ladies with a love for the true and the beautiful, whose knowledge of how to raise flowers and garden plants can be brought into play, and what is more refreshing or genuinely educative than to bring rich young life into touch with elderly women whose lives have been made radiant with good deeds and close communion with nature? In winter various kinds of woods that grow in the neighborhood may be collected and arranged. Questions should be given by the teacher, which will cause the children to go directly to the parents for information concerning the kinds of trees most profitable to raise for wood, for shelter, for ornament. Let them learn concerning rapid and slow growing trees, and also get information concerning the trees' enemies and how they may be destroyed. Call attention to the devastation made by the destruction of forests in Russia, also to German laws, where a tree must be planted for every one that is cut down.

Ample opportunity is here given for the live teacher to introduce literature of the highest type, such as Bryant's "The Groves Were God's First Temples," "Woodman, Spare That Tree," "The Village Blacksmith," which not only immortalizes the village blacksmith, but also the spreading chestnut tree, and, more especially, the author.

When an ample supply, well labeled, is at hand, the children will take great interest in experimenting with various soils, noting which soil holds a good deal of water, which soil permits water to pass through it freely, and which soil is impervious to water. These experiments will give clear ideas of the different varieties of soil, and will bring up the subject of drainage, which may be the basis of well directed language lessons. Seeds should now be planted in the various soils; some kept moist and warm, some in a cooler place, with about the same moisture, and others neglected as a careless farmer neglects his crops. Let the children note the dates of planting, the time of germinating, and the manner of growth. They can here learn the difference between inside and outside growers, by the manner of the growth. The growing plants should now be studied under the head of cultivation, rotation of crops, and fertilizing. Information upon these points can be obtained by the children from their parents and from successful farmers.

Let me give you an illustration of what was brought about in one of the most indifferent neighborhoods in a county in this state: In a school that came under my observation, the teacher a young woman, constructed a "planting box," as she called it, with glass sides, in which she planted seeds of various kinds that the growth of the roots might be observed as well as the stem growth. It was a real "Wonder Book" to all the children. Many of the people in the neighborhood made pilgrimages to the school-house to see the little marvel and thanked the teacher for the great progress their children had made in the "Three R's." Not a few of these persons were loud in their objections when nature study or "baby farming" as they called it, was introduced into the sacred realm of the "Three R" school-room.

Points of interest between the home and the school can in this way be kept up and the bottomless gulf between them spanned; the boys and the girls developed into thoughtful, studious young men and women, who will not be willing to leave the school at an early age, but anxious to stay until they are ready for higher courses.

If we can get the children of the ungraded schools to study their environments, our efforts will not have been in vain. We shall have introduced them into a genuine fairyland, whose queen is truth, and whose home is with the infinite God of nature, who loves the children and who has said: "Suffer the little children to come unto me, and forbid them not, for of such is the Kingdom of Heaven."

EDGAR COUNTY.

The following is taken from the announcement of the Annual Teachers' Institute held at Paris, Ill., July 10-14, 1905:

CORN JUDGING CONTEST.

An effort was made last spring to secure for each boy who wished to enter the corn growing contest, a package of five hundred grains of corn. Mr. Hostetter resigned at this time and his successor did not carry out his plans. Instead of a corn growing contest this year, each boy under eighteen years of age will be permitted to exhibit for a prize either yellow or white corn grown in any field. The contest will consist in the scoring of the corn by the exhibitor. After the corn has been scored by its exhibitor, then the same corn will be scored by a professional corn judge. The boy who comes the nearest to the professional judge will be awarded the first prize and so on. Write to Supt. Frank H. Hall, Springfield, Illinois, for a supply of score cards for all your boys. You can be of more help to your boys if you will study the score card yourself. Farmers' Institute will be held Jan. 8, 9, 1906.

Fulton County.

Lewistown, Ill., July 27, 1905.

There has been no organized effort in the work of teaching Agricultural Science in the schools of this county up to the present time.

At our annual institutes for the past three years one period each day was devoted to Nature Study or Agriculture. At the 1905 Institute Mr. C. W. Farr will give five talks on Primary Agriculture and an evening lecture on "The Farm, the Home, and the School." At the beginning of the fall term of school, an effort will be made to organize a Farmer Boys' Experiment Club.

M. M. Cook,
County Superintendent of Schools.

Note.—The following is from the announcement of the annual session of the Fulton County Teachers' Institute:

"An effort will be made at the beginning of the fall term of school to organize a Farmer Boys' Experiment Club. Teachers should therefore, get all the information possible from Mr. Farr's talks on Primary Agriculture. Let us all try to learn at least how judge corn; how to use "The Corn Score Card."

In connection with the announcement of the work in Primary Agriculture the following selection from the pen of Dean Jackman of the University of Chicago, appears:

"Whatever the line of work herein indicated may do, let it breathe hope for the country boys and girls; not the hope of a life that, to be realized, must be lived in the city, but let it rouse the anticipations of a life that has its background in the sunsets, the hills, the woods, the orchards, and the waving grain fields of the country. Whether the instrument of living is the plow or the pen, it matters but little; the furrow well turned and the line well written are both fundamental in human society."—*Jackman.*

Grundy County.

Morris, Ill., Aug. 4, 1905.

At our annual institute last August we did some work preparatory to the teaching of agriculture in our rural schools. Prof. Herbert Blair of the Duluth, Minn., normal gave one period each day to the discussion of this subject, and later assisted in preparing an outline taken largely from the more complete outline of the State Course of Study.

I find that to tell teachers "to follow the State Course in the work outlined for agriculture" is not productive of satisfactory results. This is not said in criticism of the course, but as teachers could not do *all* that is here outlined a majority did *nothing.*

We chose from Dean Davenport's course some things that all teachers might direct with little effort, and insisted on their doing this much.

Last May I requested teachers to include in their annual report a statement indicating the degree of success they had in teaching agriculture. Out of eighty-seven schools eighty-four reported as follows: Twenty-five teachers found the work interesting to pupils and the results successful; twenty-eight had "fair" results; fifteen who tried, thought their work a failure; sixteen teachers did not try, a majority of these explaining that "they didn't have time." As C. W. Farr, of the Cook county schools, works along the line of agriculture in our institute next week, we hope for better results another year.

C. H. Root,
County Superintendent of Schools.

Note—Superintendent Root has printed and distributed to his teachers a carefully prepared outline of work in "Agriculture and Nature Study" for each month. He suggests that the work may be done in connection with the opening exercises of the school, and says; "This subject is not to be taught from books, but the knowledge is to be gained at first hand that the act of acquiring it shall be of more value than the knowledge itself."—Editor.

HANCOCK COUNTY.

CARTHAGE, ILL., July 31, 1905.

For three years past Elements of Agriculture has had a place on the program of my annual institute. Prof. Frank H. Hall gave valuable work in 1903-4 institutes, and Mr. P. H. Lehman, one of the county principals, gave instructions this year. This work has been valuable in that it has opened up the field, and caused the teacher to do some individual work in the way of school and window gardening.

One of the best things I have introduced is the Boys' Corn Growing Contest, tried for the first time last year. The contest was held last February at which time Professor Hall was present and delivered an instructive lecture and assisted in scoring the corn exhibit. To show the interest manifested, a mother and her two boys drove about eighteen miles on one of the coldest days last winter in order to be present at the lecture and contest.

This year 163 boys are contesting for $25.00 in cash prizes. I hope to be able to provide for a two weeks' attendance at the agricultural college, for that boy who shall make the best individual scoring of corn. The corn contest has accomplished two great objects; first, it has been the means of introducing better corn into the country; second, it has aroused a lively interest in farm life on the part of the boy.

J. E. WILLIAMS,
County Superintendent of Schools.

HARDIN COUNTY.

ELIZABETHTOWN, ILL., Aug. 8, 1905.

The Elements of Agriculture have been introduced to some extent in our schools through the state course of study.

HATTIE M. RITTENHOUSE,
County Superintendent of Schools.

JACKSON COUNTY.

MURPHYSBORO, ILL., Aug. 5, 1905.

About one-half of the rural schools are doing the *outlines* as furnished in the Illinois state course of study. Questions on the subject of Agriculture were submitted to 110 schools in central examination this year. Nearly all of this number sent written answers to these questions. Through the efforts of the county superintendent and teachers, last year 56 boys experimented with the seed corn sent by Secretary Hostetter. Each year, in teachers' annual institute, one hour of each day is devoted to discussion of the subject of agriculture. We expect to unite one of our teachers' meetings with the Farmers' Institute meeting if congenial with the officers of the Farmers' Institute.

Would gladly receive any suggestions you may offer in regard to this subject.

EMMA M. BRYAN,
County Superintendent of Schools.

JOHNSON COUNTY.

VIENNA, ILL., Aug. 1, 1905.

We expect to have the corn-judging contest this year and to send one or more boys to the corn school at the university.

I have procured buttons for the boys so that we may designate the members of our association and encourage others to become members.

We will continue this work until we get every boy interested, if possible. The destiny of our schools and the welfare of our county depend upon this and further agricultural education.

WM. M. GRISSOM, JR.,
County Superintendent of Schools.

NOTE—Johnson county is one of the three in which the superintendent of schools is the secretary of the Farmers' Institute. Superintendent Grissom has acted as secretary for several years and has never failed to interest many of the young people of his county in the work of the institute.

He has organized a "Household Art Club" for the girls and sees that premiums are offered for sewing and bread-making, and that instruction is given in these household arts. Many boys are members of his "Farmer Boys' Association." Last year 81 boys made entries in the corn contest and nine received prizes. Every boy received a present of some kind for his exhibit.

Superintendent Grissom also offers a valuable premium for the best composition on "Birds," and one for the best composition on "Trees," the premiums to be awarded by competent judges, and premium essays to be read at the County Farmers' Institute.—EDITOR.

KANE COUNTY.

GENEVA, ILL., July 28, 1905.

The work done in the schools of this county, during the past year, in the elements of agricultural science has been in conformity with the outline given in the State course of study. In many schools the plan therein given was quite closely complied with.

Arrangements have been made for giving instruction in this subject at the next annual teachers' institute, which will be held Aug. 21-25.

Pupils, teachers, and school officers were encouraged to attend the last county farmers' institute. Many did so.

We are looking for and expecting more satisfactory results during the coming school year.

H. A. DEAN,
County Superintendent of Schools.

NOTE.—A very large number of teachers and pupils were present at the farmers' institute held in Geneva, Feb. 15, 16, and 17, 1905.—EDITOR.

KENDALL COUNTY.

BRISTOL, ILL., Aug. 1, 1905.

Plans and work looking toward an increasing interest in the elements of agricultural science are receiving considerable attention in many of the schools. The study is taught in part as outlined in the State course of study, and teachers and pupils seem interested in the work. School gardens afford opportunities for observation and experimental study of plant life. The larger boys quite generally take part in the corn growing contests and bring good exhibits to the annual farmers' institute.

During the teachers' annual institute one period daily is devoted to primary agriculture. In 1904, Prof. Frank H. Hall was present for a whole week and gave most helpful instruction for an hour daily on elementary agriculture. The teachers were in sympathy with the good work outlined, and carried out the plans suggested more or less in their schools during the year following.

Supt. Charles W. Farr of Cook county worked in our teachers' institute this summer (1905) and occupied a period daily with "Farm, Home, and School." His instruction was very interesting and we expect that excellent results will follow in the schools for the coming year. The report of the Illinois Farmers' Institute, Vol. 8, was distributed among the teachers. Every teacher received two copies, one for herself and the other for the school library. Bulletins from the experiment station. State university, were distributed also.

The good cause is coming to the front, and well it may, for the principal industry is agriculture, "Back to the land" should be the watchword.

A. D. CURRAN,
County Superintendent of Schools.

KNOX COUNTY.

GALESBURG, ILL., July 31, 1905.

Comparatively little is being done in the schools of Knox County in the way of teaching the elements of agriculture. Very, very few of our teachers have any preparation or fitness for the work and scarcely more, it seems to me, have very much disposition to prepare themselves. I hope during the coming winter to take the matter up in such a way as to get something practical done,

W. F. BOYES,
County Superintendent of Schools.

NOTE.—The modesty of the superintendent is too much in evidence in the foregoing brief report. For the last two years, Supt. Boyes has attended the Knox County Farmers' Institute and made a valuable address on each occasion. Each year he calls a meeting of the school directors of his county and they respond to his call. Last spring more than one hundred directors were present and the matter of school consolidation was thoughtfully considered. Moreover, at the Knox County Teachers' Institute the subject of Agricultural Science in the rural schools always receives some attention. The Knox County superintendent and teachers may not be in the very front in this new movement but they are far from the rear end of the line.—EDITOR.

The following is from the course of study for the common schools of Knox county, prepared by Superintendent Boyes:

ELEMENTARY AGRICULTURE.

A very great weakness of our schools is the lack of relation between the life of the pupil at home and in the school. The very purpose for which the school exists makes necessary to its full accomplishment the most intimate relation between the child's school life and his life elsewhere. This relation does not exist. It is the duty of the school to do all it can do to bring itself into touch with the outside interests of the pupils. To this end, among others, manual training and domestic science have entered the city schools. For the same reason elementary agriculture should receive attention in the country school.

It should not be considered the purpose of the work to teach the boys how to farm, but to bring to their knowledge facts and principles that relate to farming and to present them in such a way as to fix the attention of boys and girls upon the desirability of such knowledge and the advantages of life on the farm. People are interested in that about which they know something. Practically nothing of the scientific side of farming is known by the farm boys. The school should assist at this point.

Read what the State course of study has to say concerning elementary agriculture.

Text book: "Elementary Principles of Agriculture," Goff and Mayne.

It is not expected that the book will be in the hands of all pupils and regular work done each day. But earnest effort should be made to present the subject from time to time, and it seems easily possible to cover this text during the seventh and eighth years.

LASALLE COUNTY.

Being soundly convinced that the schools should aim not simply to teach reading, figuring, and writing, but that they should develop in the children the character of genuine men and women and establish right habits of living and work, I entered into this work of agriculture in the country schools with a great deal of enthusiasm.

What the public schools teach and accomplish is worth all that it costs, yet they do not accomplish one-half what they should accomplish. Knowing the value of the right kind of farm life in the development of the best and strongest characters, I knew that if the school aided the farm life and if the farm life could be made a vital part of the school, the children in the country would be the most fortunate children on earth.

I know that country life is the most natural and wholesome life for a child to live. Call the roll of the men who are leaders in the world's work or who have been leaders in times gone by, and nine-tenths of them spent their childhood and youth in the country. If the country is the best place to raise children, it is the best place to educate children. For education rightly considered is nothing more than bringing up children in the right way. The business of the teacher is to help bring up children in the way they should be brought up. Merely learning how to read, write, and figure, and learning a few facts about the earth and our own country, is but a very small part of the right bringing up of a child. He may be able to do all these things and be very poorly raised. It is the man who does the right from knowledge and from choice who can do, and does, the most useful work within his power—that is the man who has been rightly raised. The country school ought to be the best school on earth. Why is it not? Because, as now conducted, it is not a place for the education of the children. It is a place where they acquire simply the elementary tools with which to secure an education. It is the life on the farm—the education of the farmer—that lays the foundation for greatness in so many farmer boys' lives. The education of the country school counts but little in that foundation.

I saw in this movement a long step forward. The farm life, the farm knowledge, the farm work, the farm experiences, its successes, its failures, its joys and its sorrows were to be made an integral part of the school. The school was to become a place of real living and the best kind of living.

When I found that the farmers' children were ready and enthusiastic to undertake it, I was much elated.

About 400 boys and about 300 girls enrolled in the Young People's Farmers' club. I sent out the following circular:

YOUNG PEOPLE'S FARMERS' CLUB, LASALLE COUNTY, ILLINOIS.
U. J. Hoffman, Director, Ottawa, Illinois

TO FATHERS AND MOTHERS.

In the minds of many people there still lingers the false notion that learning out of school books is education. Education is something that helps one make a living without work. This is far from the truth. Book learning is all very good in its way, but alone it is quite useless and even detrimental.

The educated man is one who knows and can do. Knowledge without ability to do something makes a dreamer, a visionary. Work without knowledge makes a drudge. Knowledge and work, one helping the other, makes a real man.

The worst defect in a poor school is that it seeks to give knowledge only. The worst defect in a poor farm home is that it offers the children work without interest, pure drudgery. No greater punishment can be inflicted than to have to do work which does not arouse one's thought and interest. No greater good can come to one than to be able to work at something that occupies the whole mind with the delight of doing something worth while.

Many a man farms because he can make a living no other way. He would leave the farm in a minute, even to peddle something, if he could get the chance. This is the worst atmosphere in which to bring up children. They hear the father and mother deplore the fate that keeps them on the farm. They hear how much better off is the man in town. They drudge at home and when they are sent to school it is with the advice, "to learn something so that you won't have to work as hard as we do."

Thus neither the school nor the farm home do for the child what they should. The school should awaken, quicken and sharpen his mind. It should give him the learning of books, an interest in the higher things of life, and dispose him to make use of what he learns, and what he thinks in doing something for others and for himself. The home should give him a chance to use his mind and his hands to do useful work. The school and the home must work together if the children are to grow to be useful men and women.

Farming is capable of affording as much interest and joy in useful work as any calling in which man may engage. Indeed life on the farm, if rightly pursued, offers the best opportunity for a healthful, virtuous, peaceful and useful life. We are taught that the first man was placed in a garden "to dress it," and when the Son of Man came to teach us how to live he did not go to college to study theology; he learned the carpenter's trade. He got his education by doing useful work.

In organizing the Young People's Farmers' club it is not my purpose to make farmers of your children any more than it is to make mechanics or lawyers of them. My only purpose is to give them the best chance to become real men and women. This I think can be done by inducing the children to get useful knowledge in the schools, and learn to do useful work on the farm, and to love to do both. If I were the father of a boy and were a farmer, I would expect my son to get the best part of his education out of his farm work while he was going to school. If I were a carpenter, I would expect my son to get the best part of his education by learning the trade. If he chose to be a teacher or a doctor when he came of age, I am sure he would be either the better because of his training to work. If he chose to stay on the farm or at the bench, I know that I have done the most for him.

I ask for your earnest coöperation in the endeavor to realize this purpose in the lives of the children on the farms.

WHAT THE BOYS ARE TO DO.

Boys who are old enough to do so are expected to rent an acre or several acres of land of their father and plant a crop for money. Do the work themselves or hire some of it done by exchanging work with the father, pay all expenses and have the profits themselves. Corn, popcorn, squashes and potatoes are good crops to begin on. In corn I recommend that you procure high-bred seed and try to raise it to sell as seed corn.

Younger boys should rent a smaller piece of ground and raise corn for the prizes which will be offered at our Farmers' Institute next winter. All who apply to me will receive four ounces of high-bred seed corn by enclosing four cents to pay postage. A. B. Hostetter, Secretary Illinois Farmers' Institute, will send you 500 grains of high-bred seed corn for 4 cents to help pay postage. This does not debar any member from using other seed corn. The name and address of all our boys will be sent to the Agricultural College at Champaign, and Dean Davenport will send you from time to time such experiment work as the college wishes done.

INSTRUCTIONS.

I will occasionally send you pamphlets of instructions. The Agricultural College will do the same. The Agricultural Department at Washington will furnish us many interesting and useful bulletins. Mr. Will B. Otwell, Superintendent of Agriculture of the Illinois Commission to the Louisiana Purchase Exposition, will send you information in regard to making a boys' corn exhibit. Please file all literature sent you for further reference.

PRIZE CONTEST.

Our club will furnish the program for the Farmers' Institute for a half day. Prizes will be offered for boys' exhibits of farm crops and girls' exhibits of household work.

WHAT THE GIRLS CAN DO.

What I have said about the education of the boys on the farm is just as true of the girls on the farm. I expect to give my girls the best education that I am able to give; but no matter how good a school they may attend I expect them to get the best part of their education by being a part of the home and in helping to do the work of the home. Fathers and mothers are the best teachers of their children. The purpose of the girls' department of this club is to get them to take an interest in home-making. The girl who marries without having learned the art of home-making has had her education sadly neglected by her mother. We wish to get the girls to take an interest in the work of the home, so that it will be educational and not drudgery. The following letter from Mrs. Joseph Carter, of Champaign, is suggestive.

"DEAR MR. HOFFMAN:—You letter has lain on my desk unanswered for several days, for which I am sorry. But really your request for plan for work and study for the girls is a rather difficult one to answer, as it is entirely new to me. In the line of cooking, bread-making seems to come first; girls twelve years and older can learn to do this, and can bring a sample of their work to a meeting of the club where it can be judged in such manner as you think best, each girl telling how she made it. Then the older girls might study the bulletins on bread-making, "Studies in Bread and Bread-Making," by F. Snyder and L. A. Vorhees. Government Bulletin No. 67 and "Bread and the Principles of Bread-Making," by Helen Atwater; Farmers' Bulletin No. 112. From this study they ought to be able to write a good paper on bread-making. All ought to be taught what the good points of good bread are. Miss Ester Beatty, assistant in the Household Science Department of the University can help you just here, and will be glad to do it. She is the teacher of cooking.

"Other kinds of bread, as whole wheat, corn, rye, Boston brown bread and light rolls might be included. If at a meeting some one competent to do so could give them a talk on the subject, showing yeast plant and starch grains under the microscope and telling them of the changes the starch undergoes by cooking, etc., it would be most profitable, and interesting, too,

"Now for sewing. There is a little book published by Silver & Burdette, costs fifty cents, which gives a course of sewing for schools. Now, it seems to me that every girl might buy this and carefully follow out the lessons, bringing in her work to the club meetings for approval or for criticism, or for prizes if you give them.

"I went to the University and talked with Dean Davenport and Miss Bevier and Mr. Rankin. They will do what they can to help you and you can write to them.

"Now, what I have suggested may not be of any value. This is an entirely new line of work for all, but out of this work with the boys and girls I know good will result. If I can be of any use in helping to work out the problem, I am ready to serve you.

Very truly yours,

(MRS. JOSEPH) JANE P. CARTER."

INFORMATION.

First of all, ask your mother if she will teach you how to keep house. Of course she cannot do this all at once. You are to learn one thing at a time. Baking, sewing, mending, cooking, decorating rooms, planning the meals, what kind of foods should be provided at a meal, managing the expenses—there is enough here for ten years of study and practice. You are to try to be a partner in the management of the household duties.

I will send you, from time to time, such information as I can secure for you. Every girl sixteen or more years of age ought to be able to manage the housekeeping for weeks at a time and give mother a chance to visit and rest. Do not be put off with, "Ah, it's more bother to teach you than to do the work myself." Insist that you want to learn.

MEMBERSHIP.

Any boy or girl between the ages of ten and twenty may become a member by giving me name, postoffice, age and school district. There will be no expenses which the members will be called on to meet.

EDUCATIONAL EXCURSIONS.

Some time in June we will arrange for an excursion to the Agricultural College at Champaign. The members and their parents will be invited to go and inspect the school and the experiment farm. Round trip ticket will probably be about $2.50.

Hoping that many boys and girls and their parents will become interested in this movement for practical education, I am sincerely

Your friend,

U. J. Hoffman.

I furnished them all the useful information I could get from Washington and the University of Illinois. I urged the teachers to encourage the boys and girls and assist them as much as possible.

My enthusiasm took on a more somber hue when I learned:

1. The girls from town who teach the schools lay down their arms as soon as they encountered the incredulous smile, the derisive laughter, or the emphatic negative of the directors when they asked to have a small part of the school yard spaded up for a garden.

2. Four fifths of the boys were told: "I send you to school to learn books. I'll teach you all the farming you want after school is out."

I called on the boys to exhibit their corn and the girls their bread and sewing at the farmers' institute. Twelve boys brought corn and one girl brought bread. All of them received prizes.

The next year I urged the boys to take advantage of Mr. Otwell's offer of seed corn and an exhibit at the exposition at St Louis. About 500 sent for the corn. Less than a dozen sent corn to St. Louis. Lack of encouragement and cöoperation of the fathers discouraged the boys. Nothing was done with the seed.

This year I sent out the following circular:

To the Farmer Boys of LaSalle County, Illinois:

Dear Friends—Your school will soon close and you will lay aside your school books. This, however, does not mean that you will stop learning. It may mean, and should mean, that you will now learn things that are of more use than the things you learned out of books. You will now go to work to help produce some things to feed and clothe and shelter human beings—members of your own family. The work that you do on the farm is as honorable, and may be as pleasurable and as educative as that done by any other workman. The things that you may learn from nature, the training which you may get from work in the field, furnishes the stuff out of which manly character is formed.

When I find a boy who takes an interest in his work on the farm, and who tries to do his best, I know that he will be a real man. To know how to talk and how to write is good, but to know how to do something and like to do something is much better.

You will be called on to help your father with his work. If you will enter into the work for him with pleasure, and try to do it well you will never regret it. If your father can trust you to do well everything that he asks you to do he will be proud of you. For you to be trustworthy will make you a man who can be depended on. The good jobs are always hunting for the man who can be trusted. The man who cannot be trusted is always looking for a job.

But I would have you have some work for which you are yourself responsible. I would like to have you go into business for yourself on a small scale.

I suggest that you undertake to raise potatoes. Ask your father for the ground and the seed. You can agree to pay him for the rent of the land and the seed out of the crop you raise. The rest you can sell.

I will send you several pamphlets published by the Department of Agriculture at Washington and by the State University. By studying these you will learn much about potato growing.

If the season is fovorable, the ground good and with proper care, you should raise from 100 to 200 bushels per acre. If these conditions are very good, you should raise 300 bushels. After you have paid for the land, for seed, and for help in plowing, digging and marketing, you should have a nice little sum of money. This you might invest in pigs or calves, and in a few years you will have enough to start quite a business.

Probably seventy-five bushels out of every 100 consumed in this county are shipped in and sold from 50 cents to $1.00 per bushel. If the country boys could supply this county with potatoes, it would be a proud day for the county. The good which the boys will get out of doing the work will be of more value than the money.

If you wish to undertake this send me your name and postoffice address, giving rural route, and I will send you such instructions from time to time as will be helpful to you. Wishing you success in this undertaking, I am,

Your friend,
U. J. Hoffman,
County Superintendent of Schools.

Ottawa, Ill., March 4, 1905.

Ninety-five boys have enrolled and I have sent them half a ton of reading matter. The funny man in one of the local papers, a school teacher of fifteen years ago, thinks this a huge joke, the most ludicrous "fad." He has occupied much of his valuable space with the wit and wisdom of his fertile mind.

The reader may get the idea that this is pessimistic. Yet I am not a pessimist. Good can come only by telling the truth.

My conclusion is that under present conditions we must be satisfied with little. The slow education of the people, the parents, is all that we may reasonably expect. Fifteen years ago the most advanced of us would have laughed at the idea of agriculture in the schools. We had the same idea of the purpose of the school then that the people have now. The difficulties in the way are:

1. The small country schools and the consequent indifference to them on the part of school officials.

2. The lack of leadership and supervision among the teachers. There is no one to lead except the county superintendent. He is too far away and cannot meet the teachers often enough.

After the lapse of at least twenty-five years, the schools may be consolidated in the township and the pupils conveyed to and from school. Enough ground will then be given for a school garden. The principal will be a married man and live on the school ground and will live the country life. Then we shall have the ideal country school, a place where the children will really live, and where they will grow into the real life as men and women.

Respectfully,
(Signed) U. J. Hoffman,
County Superintendent LaSalle County.

LEE COUNTY.

Dixon, Ill., July 31, 1905.

I have had the subject of agriculture taught in my annual institute several times, and have asked my teachers to devote what time they could, conveniently, to the subject.

We don't aim, however, to make farmers of all pupils who attend the rural schools.

I. F. Edwards,
County Superintendent of Schools.

Note.—It is the aim of no one "to make farmers of all pupils who attend the rural schools." But we should like to have the boys who will be farmers know that there is an agricultural college and experiment station in Illinois. President Roosevelt says that nearly one-half the people in this country devote their energies to producing things from the soil, so we think that nearly one-half the boys who go to college should go the agricultural college and nearly one-half of those who do not go to college should have their faces turned towards scientific agriculture and should be so trained that they can understand, appreciate and apply the lessons taught by the experiment station and the U. S. Department of Agriculture.—Editor.

MADISON COUNTY.

UPPER ALTON, ILL., Aug. 2, 1905.

The rural and village schools of this county have been doing for some years the work in agriculture as outlined in the State course of study, and for the past three years agriculture has been one of the topics in our teachers' annual institutes.

Supt. Joseph Carter had charge of the work the first year, and Frank H. Hall the other two years.

Questions on this subject as well as on others, are sent to the teachers for review purposes at the end of each month of the school year.

R. L. LOWRY,
County Superintendent of Schools.

MARION COUNTY.

SALEM, ILL., Aug. 3, 1905.

Many of our county schools are doing some work in the elements of agricultural science.

The State course of study is used as a sort of guide for the work of each month, but we are unable to do all the work outlined. Weather records are kept for one or more months. Collections are made of seeds, leaves, and native woods. Monthly, central, and final examination questions are given on this as on other subjects. At my request, the Agricultural Experiment Station of the U. of I. sent each teacher in the country schools copies of Circular No. 68, "Methods of Maintaining the Productive Capacity of Illinois Soils," and Bulletin No. 96, "The Testing of Corn for Seed." The teachers were asked to read these to their pupils, and to discuss the contents with them, during last February and March.

Blanks were prepared on which the teachers sent me the names and addresses of boys from 12 to 18 years of age, residing in their respective districts. These lists were sent to Mr. Fred H. Rankin, superintendent of agricultural extension work, U. of I., with a request that he send the boys the bulletins and other printed matter issued by his department, suitable for boys. Scores of our boys have been reading some very excellent bulletins received in this manner, which I am sure will inspire them to know and practice more of the new agriculture.

No attempt has been made to organize the farmer boys into clubs.

On my recommendation and solicitation, the management of our county farmers' institute has agreed to pay the expenses of some boy at the "Two Weeks' Course in Agriculture" to be given by the U. of I. next January, for the best corn judging at our next farmers' institute.

Our county teachers' association meets with the farmers institute for one day each autumn. The plan meets general approval.

The following requirements and questions were used in the Marion county final examinations in 1905:

1. Tell how the moisture may be prevented from evaporating from the surface of the land. Name as many nitrogen-producing plants as you can.
2. Name some breeds of the following: (a) Draft horses; (b) beef cattle; (c) dairy cattle; (d) black hogs; (e) white hogs.
3. What is grafting? What is its purpose? What is budding? Name two kinds of fruits commonly grafted; two that are commonly budded.
4. Define: Fetlock, pastern, cotyledons, barometer, petals, protein, incisors, nodules, Babcock test, shredder, silage.
5. In what ways is pollen brought to the pistils of the flowers in different plants. Compare the teeth of the cow with those of the horse and sheep.

J. E. WHITCHURCH,
County Superintendent of Schools.

MARSHALL COUNTY.

LACON, ILL., July 29, 1905.

We have the elements of agricultural science taught in our annual teachers institute for the past two years.

We follow the outline in the Illinois course of study for the common schools. Nearly every school in the county pays some attention to the elements of agriculture.

E. FRANK PERRY,
County Superintendent of Schools.

McHENRY COUNTY.

WOODSTOCK, ILL., Aug. 1, 1905.

The elements of agricultural science have been presented in a systematic way in but a few schools of McHenry county. A few schools have used text books on this subject as supplementary reading matter. Considerable interest has been awakened, but lack of preparation and initiative on the part of the teachers, combined with the dearth of pupils in many of the country schools, has been a serious obstacle to its general introduction. The class of farmers who attend the farmers' institute and are responsible for its perpetuation is uniformly in favor of teaching elementary agriculture in the country schools. I regret to report that a much larger class is indifferent. However the sentiment in favor of its introduction is growing. Many teachers have awakened apathetic communities by establishing and maintaining school gardens. Union meetings of farmers and teachers in different sections of the county have been very effectual in broadening the interests of the teacher and arousing the sympathies of the farmers. Coöperation is being encouraged in every way. The past two years have been marked by a radical change in the method and nature of our annual mid-winter teachers' meeting. Efforts have been centered on bringing about a union meeting once a year of those community forces that contribute to the maintenance and improvement of wealth, health, beauty, intelligence, morality, and sociability of our county. The results thus far are very satisfactory. The organization is known as the McHenry County Federation of Rural Forces. As the county is largely rural in its population and in its industrial pursuits, the farmers' institute will be recognized as the predominant and central organization of the federation. The last meeting was largely attended. Practical farmers, business men, lawyers, editors, pastors, teachers, members of the W. C. T. U., and the domestic science association, participated in the program of the joint meeting. The general discussions were always spicy and helpful. The industrial element in education was one of the most important subjects discussed. In fact, one whole evening of the two days meeting was given to this subject. We feel that such meetings as these are not only very helpful to the schools, but that the broad range of interests represented and discussed, will contribute to the improvement of rural conditions. We hope that we are sowing the seeds in the minds and hearts of the people that shall ultimately ripen into a desire for more rational methods on the farm, and that they shall not only see the necessity for the introduction of agriculture into our country schools but that they shall be aroused to a due appreciation of the importance of all industrial education in fitting our boys and girls for efficient service. It seems to the writer that the plan of federation as a method in working out better community conditions has a materialistic parallel in the idea of balanced rations for the dairy cow. Of the six fundamental requisites for ideal community life, wealth (with due apologies to the critics of our demoralizing commercialism) is a prime necessity. Increasing wealth, i. e., the increasing of the productiveness of the soil, causing two blades of grass to grow where one grew before, improving the quality of our domestic animals, is largely, not wholly, the text of the farmers' institutes. The farmers' institutes make no false pretensions. They have never offered to solve the whole of the rural problem, but they have certainly done noble service in their chosen field, and with the key of science are fast loosening the shackles of blind drudgery. Too much of drudgery, with too little of art, science, and ennobling companionship has made country life distasteful to our boys and girls. Coöperation is the method of social progress. Let us then by coöperation find the balanced ration for the country boys and girls. Wealth alone will not suffice. He needs time and material for plays and games in which to develop his moral perceptions, his social nature, his civic ideas and his growing physique. He needs art to feed his æsthetic nature and in which to find his noblest self. Let us strive to give him all the opportunities for securing knowledge, culture, and companionship that are enjoyed by his city cousins, minus their corrupting influences. Then his unformed judgment will no longer be dazzled by the superficial glitter of city life, and, moth-like, be led into a destroying flame. If, perchance, he goes to replenish the impoverished blood of crowded centers of population, it will be with moral fibre equal to the strain of his new environment.

We have organized in McHenry county three boys' clubs. These are known as "Leagues of Rural Progress." They are organized for work along the same broad lines that characterize the federation, and, in fact, they will take a prominent part in the next annual meeting of that organization. The meetings that have been held thus far have been open air meetings held at some of the most attractive country homes. The plan comprehends the organization of twenty of these leagues in the county, territorially coincident with twenty groups of schools that hold annual township exercises. The plan also embraces the organization of the same number of leagues for the girls of the county. The local leagues will be unified in a county league. Rural lecture courses and entertainments are already being arranged for those leagues now organized.

G. W. Conn, Jr.,
County Superintendent of Schools.

[Note—The organization of the educational forces of McHenry county under the leadership of the county superintendent of schools is unique and efficient. The plan is worthy of examination by all who are interested in the educational uplift of the rural population.—Editor.]

Monroe County.

Waterloo, Ill., Aug. 1, 1905.

We have not given much time to the study of agriculture in the schools of Monroe county. About ten of our teachers have taken up this subject, following the outline in the State course of study.

Henry Eisenbardt,
County Superintendent of Schools.

Ogle County.

Oregon, Ill., Aug. 1, 1905.

The Farmers' County Institute conducts a corn-growing contest each year for the purpose of creating interest among the boys in that work. For the last two years questions upon agriculture and household arts have been prepared by the county superintendent for each month as outlined in the State course of study for each of these subjects, and a review of the work for the year is sent out for the nine month's work to every school in the county. In addition to this a number of farmers' bulletins have been sent to each school from the agricultural stations at Washington, D. C. and Urbana, and suggestions made for other bulletins to be asked for. Some of this work has been taken up at the annual institute in one or more addresses.

Emery I. Neff,
County Superintendent of Schools.

PEORIA COUNTY.

Agriculture is a required study in the seventh and eighth grades of the rural and village schools of Peoria county. The outlines given in the Illinois State course of study are followed as closely as the conditions in the several districts warrant. Sometimes it is necessary to omit a few topics that are practically impossible of study in a given district. Many schools do additional work; this year a number of schools made a special study of birds and sent in handsome note-books. In general, this work is done just as outlined and kept in special note-books. These note-books are given to the county superintendent at the time of the final examination in the spring and a grade is given on the note-book—no other examination being required.

The pupils see that it is possible to get a very good grade and therefore are careful to have excellent books. Many have gone to an expense of several dollars on a note-book—one having cost $7.00. Some have kept the work on loose sheets and at the close of the year had these artistically bound at a good bindery.

There were about three hundred note-books handed in this year.

When there are at least five from any one school they are entered at the State Fair, and Peoria county has won both the first and the second premiums each year for three successive years.

A few classes that had completed the work in agriculture took up the work in domestic science as outlined in the State course.

There are several texts on agriculture in each school to which pupils and teachers may refer in their studies. Reports of the department of agriculture help some. Many things are found out by actual test. A number of schools have splendid gardens.

The parents quite generally take considerable interest and aid their children. Agriculture is recognized here as one of the important subjects of the school course and the teachers are usually as faithful in giving instruction in this as in the older subjects of the curriculum.

C. U. STONE.
County Superintendent of Schools.

NOTE—At the request of the editor of this report, Superintendent Stone makes the following supplemental statement:

A year ago in district seventy-five—Smithville school—with Mr. Geo. W. Scott as teacher, the advanced pupils contributed their pro rata and sent one of their number to the University of Illinois to get instruction in using the Babcock test. As soon as he was familiar with it, he returned and tests were made at the school. The farmers became interested and often went after school hours to observe the work. Finally one of them purchased the tester and it is now used in the district.

This is only one of the many incidents that have resulted from the study of agriculture.

C. U. STONE.

PIATT COUNTY.

MONTICELLO, ILL., July 31, 1905.

All of our rural schools do the work in agriculture outlined in our state course of study by Professor Davenport, and many of them are doing it in a very creditable manner. This subject is included in the list of subjects for our monthly, central and final examinations.

This spring we organized boys' and girls' experiment clubs. The boys are raising corn and the girls are devoting their time to raising chickens, making bread and canning fruit. They are taking a great deal of interest in the work, are reading the farmers' bulletins furnished by the U. S. Department of Agriculture and are doing the work in a practical way.

At our summer institute we will devote one full period each day to the subject of agriculture, to be presented by Prof. Frank Hall.

CHARLES MCINTOSH,
County Superintendent of Schools.

PIKE COUNTY.

PITTSFIELD, ILL., Aug. 3, 1905.

I have required all applicants for teachers' certificates in this county to pass an examination in the Elements of Agriculture, as well as in the branches prescribed by law, during the past three years. Teachers are expected to teach the work outlined in the State course of study in their schools, and all graduates from the common school course must have passed an examination on the same.

CAROLINE GROTE,
County Superintendent of Schools.

POPE COUNTY.

GOLCONDA, ILL., July 31, 1905.

We have discussed the agricultural question in our institutes and some few of the teachers have done part of the work planned in the course of study, but we are only beginning the work in this county.

M. LILLIAN BAKER,
County Superintendent of Schools.

PUTNAM COUNTY.

GRANVILLE, ILL., Aug. 1, 1905.

We have had the teachers take a course in the normal schools, also institute work on this subject. If I am not mistaken, we were the first to have a regular institute instructor in this work.

The boys plant corn and make an exhibit at the annual Farmers' Institute.

GEO. W. HUNT,
County Superintendent of Schools.

RANDOLPH COUNTY.

CHESTER, ILL., Aug. 2, 1905.

Nearly all of the rural schools and some of the grades in the towns in this county are doing something towards agricultural instruction. We make an effort to follow the State course of study, and several of the teachers are getting good results from the work as outlined in agriculture. They tell me that the pupils become very much interested and are quite anxious to make the collections, some of which I have found to contain quite a wide variety of seeds, leaves, etc. The pupils are also required to make observations and give the results. This work is all done in the form of general exercises. A few of the schools have made some effort towards the school garden.

For the past few years our teachers have been required to pass an examination in the Elements of Agriculture. The subject has a prominent place on the program of our annual institutes and comes in for a good share of the discussion at the bi-monthly meetings.

MAURICE A. MUDD,
County Superintendent of Schools.

ROCK ISLAND COUNTY.

ROCK ISLAND, ILL., July 26, 1905.

The work in this county is not as satisfactory as I might wish it to be, yet something is being done. I have attended the farmers' institutes in this county for the last two years and am in hearty sympathy with the effort being made to introduce some very simple work in nature study and agricultural science into the rural schools.

S. J. FERGUSON,
County Superintendent of Schools.

SCHUYLER COUNTY.

RUSHVILLE, ILL., July 26, 1905.

The officers of the Schuyler County Farmers' Institute did not provide for a meeting last year, and consequently the boys did not have an opportunity to exhibit their corn. We hope they will have a rousing meeting this year. I furnished the boys with corn this year which I procured from H. A. Winters, Wenona, Ill. They seem to be very much interested in the subject of corn-raising.

About twenty teachers in this county did something in the way of teaching the elements of agricultural science last year and some of them created a great interest in this work.

I shall urge all my teachers to do this work this year according to the work outlined in the Illinois state course of study. Many of them are afraid of it because they feel the work is too hard for them to do. As soon as we correct this error, we shall get along nicely.

J. ROLLO BLACK,
County Superintendent of Schools.

NOTE.—Superintendent Black has arranged for the presentation of the subject of agricultural science in his annual teachers' institute for the last two years.—EDITOR.

STEPHENSON COUNTY.

FREEPORT, ILL., July 26, 1905.

The work is being taken up in a great many of our schools in a systematic and aggressive manner. As a guide, I have recommended a text in this science, but both teachers and pupils are beginning to recognize that the mother nature book is the greatest and best text to use.

You have gone up and down and across this state advocating that we must deal with things, and in the science in question we find the truth of your "psalm" most amply verified.

Agriculture has had a prominent place on our annual institute programs for a number of years, and a wholesome awakening along practical and necessary lines has been the happy result.

CYRUS GROVE,
County Superintendent of Schools.

NOTE—Nearly 1,000 people attend the farmers' institute at Freeport, many of whom are teachers and pupils of the public schools. The county superintendent of schools is always present and takes some part in the work.—EDITOR.

VERMILION COUNTY.

DANVILLE, ILL., Aug. 10, 1905.

We have been following the outlines of the agricultural work in the Illinois course of study. We also have been taking up some observation work and we have recommended two or three books for collateral reading along this line. While not a great deal has been accomplished, I feel gratified at the interest which has been aroused and I begin to see the results in here and there a school garden, a local corn contest, or bread making contests in several townships and school districts of our county.

R. B. HOLMES,
Superintendent of Schools.

WABASH COUNTY.

MT. CARMEL, ILL., July 26, 1905.

We are trying as best we can to follow suggestions in the Course of Study relative to agriculture. The children are encouraged to make flower gardens at school and at home and to do some experimental farming on a small scale. About all we have been able to do is to encourage the child to observe closely the different plants, their characteristics, etc., and to awaken within him a desire to know more of the life history of the things about him.

We are not accomplishing as much as we would like to accomplish; but, as you are no doubt aware, the difficulties are many, and we hope to do more and more toward encouraging boys and girls to stay close to nature "and list to nature's teachings," that is, to stay on the farm and *live.*

A. E. SMITH,
County Superintendent of Schools.

WHITESIDE COUNTY.

MORRISON, ILL., Aug. 12, 1905.

While there is not so much interest in the cause of agricultural science in the schools of this county as I should like to see, some good work has been done the past year. Arbor day was quite generally observed and many attempts at school gardening on a small scale were made. Flowers on school grounds in this county are not now an uncommon sight.

B. F. HENDRICKS.
County Superintendent of Schools.

NOTE.—Superintendent Hendricks is one of the three county school superintendents who is at the same time secretary of the county farmers' institute. He manifests great interest in the educational phase of the farmers institute work and the results can not be otherwise than helpful in spreading the gospel of a better agriculture.—EDITOR.

WILLIAMSON COUNTY.

MARION, ILL., July 27, 1905.

We have work along the line of agriculture in the country as well as the village schools; also some work is done in the high schools. This year I have offered three cash prizes to the boys of my county for best corn grown by them. The prizes offered are $10.00 for the best, $5.00 for the second, and $2.50 for the third, making in all $17.50.

R. O. CLARIDA,
County Superintendent of Schools.

WINNEBAGO COUNTY.

Superintendent Kern, finding himself too busy to prepare even a brief report for use in this volume, the following facts taken from published statements concerning his work, are given herewith.

As early as February, 1902, Superintendent Kern organized "The Farmer Boys' Experiment Club." There were thirty-seven charter members. Soon after the organization of this club, an excursion to the agricultural college was planned. On June 5, 1902, 130 boys and 150 adults visited Urbana and spent one day in the study of the work being done in the college and experiment station.

Soon many of the boys of Winnebago county were zealously engaged in making experiments for themselves. In the spring of 1903 nearly 200 members of the club were supplied with pure-bred seed corn by the Illinois State Farmers' Institute. Each received 500 grains and each was expected to "note all the interesting facts about the growth of the corn and make an exhibit of the ten best ears at the county farmers' institute." Local meetings of the club were held and the members were addressed by Professor Holden of Iowa, Dean Davenport of Illinois, Dean Henry of Wisconsin, and others.

PROF. O. J. KERN.

A "Girls' Home Culture Club" was organized, too, in which the county domestic science association took great interest.

These clubs have maintained an active existence up to the present time and have done unmeasured good in creating a wholesome sentiment concerning education in the rural schools. At this writing, the members of the boys' club are engaged in the production of sugar beets to be shipped to a factory in Wisconsin when mature, under the direction of the county superintendent of schools.

In June, 1903, a second excursion to Urbana was planned. At this time there were 328 members in the boys' experiment club, a large number of whom took advantage of the low rate—$2.50 for the round trip—to visit one of the great sources of agricultural information and inspiration.

In June, 1904, a similar excursion was made to the agricultural college and experiment station at Ames, Iowa; and in June, 1905, these young people visited the corresponding departments of the Wisconsin university at Madison. Who can measure the value of the results of these four excursions, to the young people in Winnebago county? And not alone to Winnebago county, but the influence and suggestiveness of this work have been felt and made apparent in many other localities, while the name of the man who took the initiative in this educational enterprise is familiar to educators in every state in the Union. I have heard it said that "Kern is a good advertiser." He is, and he has something to advertise.—EDITOR.

WOODFORD COUNTY.

EUREKA, ILL., July 29, 1905.

We have given a full share of attention to the subject of agriculture in our last two institutes and have tried to help the teachers to develop and investigate the subject with the pupils. About twenty of our best teachers maintained school gardens and otherwise interested the parents and pupils. The inexperienced teacher cannot tell the experienced farmer how to farm. He loses his grip when he tries to do it. We are trying to master some simple. most telling features of the subject such as injurious insects and the producing of good seed corn. The sending of good seed to the boys is telling.

W. J. WHETZEL,
County Superintendent of Schools.

Note.—A large number of teachers and pupils attended the Farmers' Institute in Woodford County last year, and seemed to be interested listeners.—EDITOR.

MINUTES OF THE SEVENTH ANNUAL MEETING OF THE ILLINOIS ASSOCIATION OF DOMESTIC SCIENCE.

The business session of the seventh annual meeting of the Illinois Association of Domestic Science, was held Feb. 22, 1905, in the Universalist church, Joliet, with Mrs. S. Noble King, the president, in the chair.

After a brief review of the year's work, by the president, the following committees were appointed:

Committee on Nominations—Mrs. H. M. Dunlap, Savoy; Mrs. S. A. Forbes, Urbana; Mrs. Charles Francis, New Lennox.

Committee on Resolutions—Mrs. Fred Rankin, Urbana; Mrs. John C. Baker, Manhattan; Mrs. Louis Conant, Plainfield.

Mrs. S. A. Forbes, Urbana, gave the following report of the Housekeepers' Conference:

Last November, when the officers of the State Domestic Science Association conferred with Miss Bevier and Dean Davenport in regard to holding a conference meeting at the university, in January, 1905, it was decided, considering the crowded condition of the household science department, to postpone the conference this year, and notices to that effect were sent out.

Later, the president of the conference, feeling that there was an active demand for such a meeting, asked for a reconsideration of the decision. When the president of the association was convinced that a sufficient number of women were interested to attend, she agreed to print and circulate the usual number of programs, and call the meeting for January 23rd, to continue for two weeks as on previous years. An excellent program was provided, offering the usual attractions in the way of lectures, but omitting the demonstrations in cooking, all the facilities for such work being in constant use by students.

The severity of the weather interfered somewhat with the attendance—a fact equally noticeable on other years—but a good working number was always present, and many times the rooms were crowded. Some persons on the program were kept away by illness, but their places were always acceptably filled, and Miss Bevier, through her generous services, won the grateful appreciation of every one.

At the close of the meeting the old officers were re-elected, in the hope that some way would be provided for continuing the annual conference. The women present said that they felt that the domestic science work was as valuable to the citizens of the State as the work carried on by the farmers, and that it ought to be provided for in some permanent way and they would gladly pay membership fees to help defray expenses if a permanent organization could be effected.

Recognizing their past and present privileges as due to the initiative and efficient support of the State Domestic Science Association, they elected a delegate to attend the meeting soon to be held at Joliet, to present these opinions of the conference, with a request that the association would, if possible, give to such a plan their aid and support.

Respectfully submitted,

CLARA GASTON FORBES,
Secretary.

Urbana, Ill.

The secretary then read a communication from the executive committee of the association, as follows:

JOLIET, ILL., Feb. 22, 1905.

To the Delegates Attending the Illinois Association of Domestic Science:

Four years ago, the officers of the Illinois Association of Domestic Science, with the coöperation of Miss Bevier, head of the household science department of our State University, inaugurated a movement which they believed would be a boon to the housekeepers' of the State. It was no less than a housekeepers' school or conference, as it was called. Great care was taken in preparing the program and it was widely advertised.

The first year 1000 copies of the program were sent to as many women, but only a small number outside of the two cities, Champaign and Urbana, responded. It was thought that by another year the attendance would be increased, and again the teachers in the household science and other departments, gave freely of their time and strength, and the State Association met the final obligations, but the attendance was not materially increased. The same thing was repeated in the third year, and in this, the fourth year of the experiment, of the 106 women in attendance, sixty-nine were from the home cities, nine from Champaign county outside the two cities, leaving only twenty-eight from the State at large.

After a trial of four years, the executive committee of the association have decided that this small attendance of women from the state at large does not justify them in asking further help from the household science department of the university, a department already overtaxed with its own work, nor do they feel at liberty to use the funds appropriated to state work for so small a representation.

They deeply regret that more women did not take advantage of this splendid opportunity offered, but in view of the above facts they have decided to discontinue the Housekeepers' Conference as a part of the work of the Illinois Association of Domestic Science.

They do most earnestly thank Miss Bevier and her able assistants for their unfailing courtesy and for their efforts to help in making the conference pleasant and profitable.

MARY R. KING, *President.*
MARCELLA E. CHALLACOMBE, *Vice President.*
SALLIE ANTHONY, *Secretary.*

Mrs. H. M. Dunlap gave the following report of the State Fair Cooking School:

The State of Illinois, as far as it is known, is the only state in the Union that has upon its state fair grounds a women's building.

In 1896 a paper on "Household Economy" was read before the State Farmers' Institute in the Senate chamber at Springfield. At its close, Mr. L. H. Coleman, of Springfield, arose and offered the following remarks and motion:

"We have just listened to a paper on one of the most important subjects now before the American people, and this institute should give further consideration to the matter. I, therefore, move that the chair appoint a committee of two ladies and one gentleman to formulate a plan and present the same to the State Board of Agriculture, looking to the establishment of a school of domestic economy, to be conducted on the State fair grounds during each annual exhibition."

The motion was adopted and the president appointed as said committee: Mrs. H. M. Dunlap of Savoy; Mrs. Maxey of Morrisonville and Mr. L. H. Coleman of Springfield.

The committee never met as a whole, for shortly afterwards Mrs. Maxey resigned, leaving Mrs. Dunlap and Mr. Coleman to perform the work of said committee. Agitation of the subject was started by the committee and continued to its present successful issue. In the fall of 1896 and 1898, domestic science lectures were held in the dome building, and interest had been awakened sufficient so that the Forty-first General Assembly made an appropriation of $8,000.00 to erect a woman's building on the fair grounds. This building was designed by a woman and was almost perfect as to beauty and arrangement. It was built of wood and, through some defect in construction, it took fire at the beginning of the school in 1901 and was totally destroyed. The loss of building was covered by insurance amounting to $8,000. Again the work was undertaken to secure another and larger appropriation for a building, as the first building was found to be too small for the work. At the session of the Forty-third General Assembly an appropriation of $25.000.00 was granted for the building with the $8,000.00 of insurance to be used for equipment. This building is of brick with the first floor occupied with large lecture hall and public comfort rooms. The second story is devoted entirely to the domestic science school and includes reception room, dormitory, dining room and kitchen.

The building is under the direct care and management of the Board of Agriculture. This board appoints a board of women managers to carry on the work of the school. The present board is as follows: Mrs. H. M. Dunlap, president; Mrs. W. L. Frisbie, Rockford, secretary; Mrs. Rose Carr, treasurer. While this building is under the control of the Board of Agriculture, yet it was inspired and carried to a successful issue through the workers in our Farmers' Institute, so both are interested and should work together for the success of the domestic science school in the woman's building on the State Fair grounds.

The domestic science organization, affiliated with the Farmers' Institute, was organizing counties in the work, and so it was deemed best to secure the students for this school through this organization.

It has been thought best to take one girl from every county in the State organized in domestic science and give her a two weeks' course under the best teachers obtainable. We have now about ninety counties organized, and, as you see, if every county was improving its opportunity, we should average somewhere near ninety pupils.

Last year we had about thirty-five. Some counties sent several pupils, one as many as four.

The capacity of our building is somewhat disappointing, as fifty pupils will be the limit that we can accommodate, so those desiring a scholarship for the coming fall should make the application early, as the first who come will be the first to be served.

The words of appreciation that come from former pupils certainly prove that the school is doing good work. I think some are aware of its value through the pupils who have returned to the several counties and given a report in part of what they learned. It is one of the requirements of the school that at their county farmers' institutes they are to help disseminate the knowledge by making these reports.

The practical help to be derived from a school of this character can scarcely be estimated. From 6:00 in the morning until 7:00 in the evening, they are almost constantly employed either in the lecture room or in the performance of some of the duties of the school, as all of the work of the dormitory, dining room and kitchen is performed by the pupils.

The last session was considered as one of the most successful terms. Miss Imogene Belden, teacher in domestic science in the Philadelphia high school, was in charge of the school, with Mrs. Helen Armstrong as her able assistant. Miss Edith Allen, of Delavan, a pupil of the university household arts department, had charge of the dormitory work and instruction.

The girls are divided into four sections, the work of each section being changed daily, so that every fourth day successively a girl will have practice lessons in the kitchen, dining room and dormitory.

The technical part of the school work is presented twice a day in lectures given in the lecture hall. These lectures are open to the general public during the time of the fair, so every attendant at the fair can, if she so desires, have the privilege of said lectures, free of charge. At the close of the school the pupils are examined on the work done, and the one receiving the highest mark has the privilege of returning again the next year if she so desires.

Miss Gardner, of Champaign county, received the highest mark last year. Three evenings of the week they were given physical culture exercises by a special teacher, which is believed to be a very valuable part of the course of instruction.

All instruction is free, through the kindness and courtesy of the board of agriculture. All the expense that the pupil must bear is the railroad fare and for the food consumed. The amount for the latter is usually $6.00 for the full term of two weeks.

The age limit has been removed, so that many of our married housekeepers are taking advantage of the school and are among the most enthusiastic students present.

It is to be hoped that the delegates here from the various counties will gain interest enough in this good work to go home and seek for a pupil from each county for this school the coming year, who will be a credit and benefit to the county—at least it is hoped that enough will be interested to fill our building to its full capacity.

A report of the committee appointed to secure an act of the State legislature making the study of domestic science a part of the State course of study, was submitted by the chairman, Mrs. S. Noble King:

This committee has no report of its own to make. It was considered unwise to attempt to secure such an act until the teaching of agriculture in the public schools was asked for, and until the time seems more favorable, this committee urges all to work for the introduction of domestic science into the school which is nearest.

MARY R. KING,
Chairman.

The report was accepted and the committee discharged.

Mrs. King, who attended the National Congress of Institute Workers, at St. Louis, in October, as a delegate from our association, gave the following report:

For the first time in the history of the association, one entire session was devoted to a discussion of women's work in institutes.

At the close, Mr. Creelman, for a number of years superintendent of farmers' institutes of Canada, and at present president of the agricultural college at Guelph, Ontario, spoke with hearty commendendation of the work and suggested that the women present take steps to organize a society of their own to correspond to the A. A. F. I. W.

After some discussion it was decided that it would be better to work with the organization already formed, and a committee of ladies, of whom Mrs. Joseph Carter is chairman, was appointed to prepare a program for their part of the next meeting.

In the reports given by the men who were delegates, only three states were mentioned as having any definite work done by women, and in these three, outside of Illinois, the work is still in the initial stage. Indiana has some good workers who are greatly interested in the work for young people. Canada is doing is doing good work in organizations similar to ours.

MARY R. KING,
Delegate.

The election of officers resulted as follows:

President—Mrs. S. Noble King, Bloomington.
Vice President—Mrs. J. R. Challacombe, Hillsboro.
Secretary—Mrs. Joseph Carter, Champaign.

On motion of Mrs. Conant, a rising vote of thanks was given to Miss Anthony for her labors as secretary during the past two years.

Mrs. King called attention to two books of Mrs. Richards'—"The Art of Right Living," and "First Lessons in Food and Diet," and recommended their use.

The Resolutions committee presented the following resolutions, which were unanimously adopted:

WHEREAS, The Illinois Association of Domestic Science is in convention assembled at Joliet, Ill., Feb. 21 and 23, 1905, and

WHEREAS, The women of Joliet and the federated clubs have given the visiting women of the Illinois Association of Domestic Science a reception in the Public Library building; therefore,

Resolved, that the members of this association desire to express their appreciation and thanks to all those women who made the occasion so very delightful to all, and

Second, to the president of the library board for his courtesy in throwing open the doors of the Joliet Public Library for use on this occasion.

WHEREAS, An essential towards home-making is furnishing nutritious food, and

WHEREAS, The skill to make good bread, and the knowledge of the composition of the same, is necessary to the ability to furnish such nutritious food, and

WHEREAS, It is our aim to train the girls of Illinois in this essential toward home-making; therefore,

Be it Resolved, that the program of the farmers' institute of every county should include the judging of bread made by the girls of the county for this purpose, the test to be made by the adopted score card, and such instruction provided in making and judging bread as is found expedient.

WHEREAS, It has become a fact that the country schools have deteriorated in numbers and are lacking in efficiency, and

WHEREAS. We consider the consolidation of country schools entirely feasible; therefore,

Resolved, that we, the members of the State Association of Domestic Science, use our influence to induce the members of the present General Assembly to favor a bill regulating such consolidation, and allowing the use of the public school fund for conducting the same.

MRS. FRED RANKIN,
MRS. JOHN C. BAKER,
MRS. LEWIS CONANT,
Committee.

It is the earnest conviction of the State Domestic Association of Illinois that there should be provided by the government an investigation of food for man, commensurate with the work already provided for the investigation of food for animals; and this association desires to bring this subject to the attention of Secretary Wilson, asking him to interest himself in providing means for pursuing such an investigation.

Mrs. Fred Rankin was appointed to write Secretary Wilson in regard to this matter.

Mrs. Dunlap asked to be allowed to say a few words, and referring to the work of the retiring secretary and of the appreciation of the association for the same, in behalf of those assembled, presented to Miss Anthony a beautiful pearl brooch.

The association adjourned to meet in the opera house at 2:00 p. m., when the following program was given:

WEDNESDAY AFTERNOON, FEB. 22, 1905.

MRS. S. NOBLE KING, Presiding.

Music.

Secretary's report..Miss Sallie Anthony.

Address—"Farmers Wives' Reading Course in New York State"........................
Miss Martha Van Rensselaer,
Supervisor of Farmers' Wives' Reading Course, College of Agriculture, Cornel University. Ithaca, N. Y.

Address—"The Proper Expenditure of Energy in the Home"........Mrs. Gertrude C. Sober,
Instructor in Household Science Department, University of Illinois, Urbana, Ill.

Address—"Domestic Science in the Normal Schools"..........................David Felmley.
President Normal University, Normal, Ill.

Address—"The Efficient Woman"......................................Miss Anna Barrows,
Director Chautauqua School of Cookery, Lecturer Simmons College,

SALLIE ANTHONY,
Secretary.

Minutes of the Meetings

OF THE

Board of Directors and Executive Committee

OF THE

Illinois Farmers' Institute,

From May 11th, 1904, to March 8th, 1905.

MINUTES OF THE EXECUTIVE COMMITTEE, WEDNESDAY MARCH 9, 1904.

INSTITUTE ROOM, 1:30 P. M.

Present—Directors, Hughes, Wyman, Chester and Easterly.

Director Hughes moved that the secretary be authorized to accept the bid of Schnepp & Lauer Co., on the furnishing of bags for sending out seed corn and printing for same at $9.50.

Motion adopted.

Director Wyman moved that an advertisement of the free libraries be printed on a booklet to be sent to the boys receiving seed corn and that warrant in payment of expense resulting thereby be drawn on the library fund.

Motion adopted.

Director Wyman moved that the secretary be authorized to equip additional libraries.

Motion adopted.

On motion, the committee adjourned.

Minutes read and approved May 11, 1900.

B. F. WYMAN,
President.

A. B. HOSTETTER,
Secretary.

JOLIET, ILL., April 13, 1904.

The executive committee met as per call of the president in Hotel Monroe at 10:30 o'clock a. m.

Present—Directors Easterly, Chester and Hughes, Supt. Frank H. Hall and Secretary Hostetter.

Director Chester moved that the secretary be authorized to purchase fifty copies of the "Creamery Patron's Hand Book" for use in the free libraries.

Motion adopted.

Director Hughes moved that the secretary be authorized to have printed 1,000 or more copies of the memorandum books for distribution among institute officers and newspapers of Illinois.

Motion adopted.

Director Chester moved that the secretary be authorized to attend the meeting of the Illinois Library Association to be held in Decatur, Ill., April 19, 20 and 21, 1904.

Motion adopted.

Director Hughes moved that our delegate to the Illinois Library Association be instructed to oppose any library legislation that would put the institute free libraries wholly or in part under the control of any other organization or commission.

Motion adopted.

Mr. E. L. Wilson, president of the Will County Farmers' Institute, met with the committee, and plans for the ninth annual farmers' institute were discussed. After a recess for dinner the committee again met in the parlors of Hotel Monroe. Directors Frake and Wyman present, together with a number of citizens of Joliet.

Director Wyman moved that the bill of H. A. McKeene, for salary as clerk, which has been referred to the executive committee by Auditor Burroughs, be allowed for the amount of $83.33, and that Mr. McKeene be paid at the rate of $83.33 a month for one year, beginning March 5, 1904.

Motion adopted.

The committee then visited the opera house, halls and barns, offered by the citizens of Joliet, for the use of the institute at the annual meeting.

Director Wyman moved that arrangements be made for the live stock class to be conducted without live animals; charts and other illustrations to be used instead.

Motion adopted.

Director Wyman moved that the secretary be instructed to prepare contract designating the halls, hotel rates and other conditions and have the same signed by the citizens of Joliet, for use at the next meeting of the committee.

Motion adopted.

The opera house was accepted for the general day sessions; the Universalist church for evening sessions and for domestic science class, and for horticultural class. The Castle hall for live stock class. The Clement hall for corn class and Woodman hall for poultry class.

On motion, the committee adjourned.

Approved May 11, 1905.

B. F. WYMAN,
President.

A. B. HOSTETTER,
Secretary.

STATE HOUSE, SPRINGFIELD, ILL.

Minutes of the executive committee meeting May 11, 1904.

Committee met at the call of the president.

Present—Easterly, Hughes, Chester and Wyman, Superintendent Hall.

Directors Schermerhorn, Mills and Abbott were present; Messrs. Shermerhorn and Mills as members of committee to secure more office room and were invited by the president to serve on executive committee for this meeting—invitation accepted.

Secretary Hostetter read the minutes of the last two executive committee meetings, and Mr. Chester moved that the minutes of both sessions be adopted as read.

Motion adopted.

The secretary read the following report and recommendations regarding the corn contest:

To the Executive Committee of the Illinois Farmers' Institute:

GENTLEMEN—I beg leave to report that we have sent out from this office, packages of 500 grains of pure bred seed corn to 5,336 boys of Illinois. Applications were received from and sent to a total of ninety-seven counties. Printed packages were sent to two counties, Lee and Ogle, and these county institutes furnished the seed.

Calhoun, Mason, Massac and Menard counties are each conducting a corn contest on their own account. Every county in the State, therefore, will do something to interest her boys in their county institute.

A booklet for keeping a record of the corn growing experiment was also mailed to each applicant to whom corn was sent.

It required forty-four bushels of seed corn to supply these applicants. The corn was secured from reliable corn growers and was of excellent quality. The varieties used were, Boone County White, Leaming, Reid's Yellow Dent and Silvermine, only one variety being sent to a county.

This corn distribution has involved the expenditure of considerable money and an immense amount of correspondence and of work in the secretary's office. We have been very generously assisted by the county institute officers, county superintendents of schools, school teachers and the press of the State. Having invested so much in the initiative and secured the coöperation of so many agencies, I recommend that every effort be made to keep in touch with these boys to the end that all of them may attend and receive valuable instruction at their home county farmers' institute. I recommend that lists of the names of the boys to whom corn has been sent, be prepared and sent to the agricultural papers which may desire to send the boys copies containing articles on corn growing and institute matters; that local papers be furnished a list of the boys in their counties with the request that the boys be encouraged in this work; that lists be sent to the county institute secretaries with the request that notice of county institute, program and premium list be mailed to each boy and a place be made on the program especially for the instruction of these boys, and also that county superintendents of schools be furnished a list with the request that schools where pupils are engaged in the corn contest be urged to attend the county institute in a body.

I also recommend that a letter be mailed to each boy who received corn, just before husking time, urging him to make selection from his plot of corn for exhibition at his home county farmers' institute, with suggestions to him how to select and keep this sample till time of institute meeting.

Respectfully submitted,

A. B. HOSTETTER,
Secretary.

Director Chester moved the adoption of the report and recommendations.

Motion adopted.

The secretary brought up the matter of warrant No. 3210 for $8.84 belonging to Director Schermerhorn and which Mr. Schermerhorn reported as having been lost, and on motion of Director Chester the secretary was instructed to draw a duplicate warrant.

Director Schermerhorn moved that the president and secretary be authorized to purchase a duplicating machine, additional filing cases and office supplies; that warrant in payment of same be drawn on fund No. 3.

Motion adopted.

Director Hughes moved that the Secretary be authorized to purchase a newspaper directory.

Motion adopted.

Superintendent Hall reported progress in organizing the bureau of speakers and the district conferences.

Director Mills, Chairman of special committee, reported as follows:

We, your special committee to secure room to carry off the increasing office work of our growing organization, beg leave to report that Hon. James A. Rose, Secretary of State, has agreed to vacate the room now occupied by him as a supply room and which was originally assigned to the Illinois Farmers' Institute.

(Signed) ISRAEL MILLS,
A. V. SCHERMERHORN.

On motion of Director Hughes, a vote of thanks was tendered Secretary Rose for the concession.

On motion, the committee adjourned.

Read and approved, July 1, 1904.

B. F. WYMAN,
President.

A. B. HOSTETTER,
Secretary.

INSTITUTE ROOM, STATE HOUSE, JULY 1, 1904.

Meeting called to order by President Wyman: Present, Mr. Grout, Schermerhorn, Mann and Superintendent Hall.

On motion of Director Schermerhorn, Director Mann was appointed to act as member of the executive committee for this meeting.

Secretary Hostetter read the minutes of the previous meeting, May 11, 1904, and on motion, the same were approved.

The Secretary presented the following financial statement:

To the Executive Committee:

GENTLEMEN—I beg leave to report to you that the balance to the credit of the several institute funds, as per the Secretary's books, available July 1, 1904, are as follows:

Fund No.	Item.	Balance.
1	Office expenses	$398 80
2	Salaries	101 00
3	Libraries	974 95
4	General expenses	89 05
6	District institutes	161 31
7	Domestic Science Association	2 47
	Total	$1,727 59

There are some outstanding bills to be paid out of the general expense fund, the total of which will amount to more than the balance now to the credit of that fund.

I therefore recomend that the unused balance in fund No. 6, for district institutes be transferred to fund No. 4.

Respectfully submitted,

A. B. HOSTETTER.
Secretary.

Director Schermerhorn moved that the above mentioned transfer viz., $161.31 from fund No. 6, to fund No 4, be made.

Motion adopted.

Treasurer Grout presented bond as treasurer for the ensuing year beginning July 1, 1904 as follows:

Know All Men by These Presents: That we, Albert P. Grout, as principal and C. H. Condit, William Neat and Percie C. Grout, as sureties, all of the County of Scott and State of Illinois, are held and firmly bound unto the Illinois Farmers' Institute, a public corporation of this State, in the penal sum twenty thousand dollars ($20,000.00), lawful money of the United States, to be paid to the said Illinois Farmers' Institute, for the payment of which, well and truly to be made, we bind ourselves, our heirs, executors and administrators, severally and firmly, by these presents.

Signed with our hands and sealed with our seals this 29th day of June, A. D. 1904.

The condition of the foregoing obligation is such that, whereas the above bounded Albert P. Grout was, on the 9th day of March, A. D. 1904 duly elected treasurer of the said Illinois Farmers' Institute for the period of one year, beginning July 1, A. D. 1904, and required to give bond in the penal sum of $20,000.00.

Now, therfore, the condition of this obligation is such that if the said Albert P. Grout shall faithfully perform and discharge the duties of his office as treasurer of the said Illinois Farmers, Institute, and safely keep all money and other property entrusted to his care as treasurer, paying the same out when ordered by the Board of Directors of the Illinois Farmers' Institute, and perform all duties required of him as such treasurer by the Board of Directors of the said Illinois Farmers' Institute, and at the expiration of his term of office as such treasurer, pay over to his successor in office, when appointed and qualified, or to such other person or persons as the Board of Directors of said Illinois Farmers' Institute may direct or require, all moneys and other property then remaining in his hands as such treasurer, then this obligation to be void, otherwise to remain in full force and virtue.

(Signed) ALBERT P. GROUT, [SEAL]
PERCIE C. GROUT, [SEAL]
C. H. CONDIT, [SEAL]
WILLIAM NEAT. [SEAL]

STATE OF ILLINOIS, }
SCOTT COUNTY. } ss.

Before me, H. D. Trickey, a Notary Public in and for said County this day appeared Albert P. Grout, William Neat, Charles H. Condit, and Percy C. Grout, to me personally known to be the persons whose names are signed to the foregoing instrument in writing, and acknowledged that they executed the same for the uses and purposes therein stated.

Given under my hand and seal this 29th day of June A. D. 1904.

(Signed) HARDY D. TRICKEY.
[SEAL] *Notary Public.*

Director Schermerhorn moved the acceptance of the foregoing bond.

Motion carried.

Bond placed on file.

Director Mann moved that the president be authorized to call a meeting of the board of directors at St. Louis, Mo., in October, during the meeting of the National Association of Institute Workers, such meeting to be in lieu of fall meeting of the board usually held in September.

Motion adopted.

Mr. Grout moved that the auditor be authorized to secure account books for the auditor's office.

Motion adopted.

The matter of the State institute program was taken up and discussed and the secretary was instructed to correspond with the parties agreed upon to be invited to take part on the program.

Director Schermerhorn moved that Superintendent Hall be authorized to arrnage for the appearance of such cuts in the ninth annual report as he may deem proper.

Motion carried.

On motion the committee adjourned.

Minutes read and approved Nov. 26, 1904.

B. F. WYMAN,
President.

A. B HOSTETTER,
Secretary.

MINUTES OF BOARD MEETING.

FARMERS' INSTITUTE ROOM,
AGRICULTURAL BUILDING, LOUISIANA PURCHASE EXPOSITION,
ST. LOUIS, MO., Oct. 18, 1904.

The board met at the above mention time and place as per call of President Wyman.

Roll call showed the following named directors present.

Abbott, Allen, Burroughs, Cobb, Dean, Dickerson, Easterly, Frake, Hughes, Mason, J. P. Mason, Mills, Newman, Rossiter, Sweet, Wyman.

On motion the reading of the minutes of the previous meeting were dispensed with.

The secretary reported for the executive committee the progress made in the arrangements for the annual round-up meeting to be held in Joliet. The program was discussed at some length and several suggestions made for guidance of the committee in completing same.

It was the sense of the members present that the Illinois Pure Food Commission be given a place on the program.

Director Newman moved that Prof. H. W. Mumford be invited to take charge of the class in live stock and to discuss the subject of cattle feeding.

Motion adopted.

Director Mann moved that the chairman of the legislative committee, the president of the board of directors and the secretary be authorized to attend the meetings of the American Library Association, Oct. 21, 1904.

Motion adopted.

Director Newman moved that the matter of securing more office room for the institute be referred to the legislative committee.

Motion adopted.

Director Allen, chairman of the committee on Soil Investigation and Experiment, made verbal report on the work of that committee and recommended that the Farmers' Institute favor additional appropriations for soil investigations.

Director Dean moved that the Illinois Farmers' Institute favor appropriations for soil investigations and experiments.

Motion adopted.

Director Newman moved that the legislative committee be requested to confer with other organizations of the State interested in the experiment station work for the purpose of securing united action in regard to additional appropriations.

Motion adopted.

On motion of Director Allen, a recess was taken till 9:30 a. m., Wednesday, Oct. 19th.

Motion adopted.

WEDNESDAY 9:30 A. M.

The board met as per adjournment. The question of timber culture was discussed at some length and on motion of Director Mann, the legislative committee was instructed to consider the question of promoting the forestry interests of Illinois through legislation.

In order to attend the meetings of the American Association of Farmers' Institute Workers, a recess was taken till 7:30 p. m.

The board met again at 7:30 p. m. Superintendent Hall was present at this meeting and made some suggestions in regard to our institute organization, stating that recommendations were being prepared by Mr. Hamilton, Farmers' Institute specialist, which might be taken under advisement for the purpose of improving our own system of institute work. Superintendent Hall was instructed to investigate the matter of securing instructors on forestry lines from the Department of Forestry at Washington.

Director Burroughs moved that the secretary be instructed to furnish each director with copy of minutes of all meetings of the board of directors and executive committee.

Motion adopted.

Director Burroughs moved that a meeting of the board of directors be called prior to Feb. 1, 1905, to consider any business that may come before the board.

Motion adopted.

Director Frake moved that the board adjourn subject to the call of the president.

Motion adopted.

Approved Nov. 28, 1904.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE IN THE PEDIGREE RECORD BUILDING, CHICAGO, ILL., NOV. 28, 1904.

The Executive committee met at the above named time and place as per call of the president, Mr. B. F. Wyman.

The minutes of the Executive committee meeting of July 1 were read and approved; members present being, Easterly, Frake, Schermerhorn, Grout and Superintendent Hall.

The secretary presented the report of Champaign County Institute expenses which was referred to the committee by Auditor Mann, and on motion of Director Grout, the secretary was instructed to investigate the claim and report to the board of directors.

The item for expenses of corn judges in the Pike County Institute report which was referred to the committee by Auditor Mann, was considered. Director Schermerhorn moved that expenses of corn judges be considered legitimate and that the bill of Pike county be allowed for the full amount.

Motion adopted.

Director Easterly moved that the president and secretary be authorized to publish a suitable catalog of the libraries and books used by the farmers' institute in an edition of 3,000 copies.

Motion adopted.

Director Schermerhorn moved that the sum of $25.00 be allowed Mr. O. J. Kern to prepare an address for the annual meeting at Joliet.

Motion adopted.

The program for the round-up was considered in detail and an adjournment taken till Tuesday at 10:00 o'clock a. m., to allow opportunity to confer with parties desired upon the program.

TUESDAY, 10:00 O'CLOCK A. M.

The committee convened again; present, Directors Wyman, Frake, Easterly and Grout. On motion, Director Abbott was invited to act upon the committee.

On motion of Director Easterly, Directors Wyman and Frake were appointed a sub-committee to visit Joliet to complete the local committees and arrangements for the annual meeting.

Director Frake moved that the president and secretary be authorized to fill any vacancies which may occur upon the annual institute program.

Motion adopted.

Director Abbott, chairman of the Legislative committee, asked for suggestions on legislative lines.

Mr. L. H. Kerrick, member of the Agricultural committee of the University of Illinois, was present and the work of the Experiment Station and the relation of the farmers' institute were discussed quite fully.

Director Frake moved that the director of the Experiment Station be requested to call a conference of the advisory committees.

Motion adopted.

On motion the committee adjourned.

Approved Jan. 14, 1904.

MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS OF THE ILLINOIS FARMERS' INSTITUTE, SPRINGFIELD, ILL., JAN. 24, 1905.

The board of directors met as per call of President Wyman.

Present—Abbott, Aldrich, Bayliss, Burroughs, Chester, Davenport, Dean, Easterly, Frake. Grimes, Grout, Mason, J. P., Mason, S. B., Newman, Rossiter and Schermerhorn.

In the absence of President Wyman, the board was called to order by Vice-President E. W. Burroughs.

The minutes of the board meeting of Oct. 18, 1904, were read, also these of the Executive committee meeting of Nov. 28, 1004, and same were approved.

Director Abbott, chairman of the Legislative committee reported the bill for appropriations for the Illinois Farmers' Institute, as agreed upon by the Legislative committee.

Director Frake moved that the bill be considered and acted upon by sections.

Motion adopted.

Director Grout moved that a sub-committee of two be appointed to act with the Legislative committee in arranging some of the sections.

Motion adopted.

The chairman appointed Directors Grout and Frake as such committee.

Director Frake offered the following resolution and moved its adoption:

WHEREAS, The Illinois Farmers' Institute has now 231 free libraries and twenty more nearly completed and ready for distribution, and

WHEREAS, There has been introduced in the Legislature now in session, a bill to create an Illinois Library Extension Board, and

WHEREAS, The Illinois Federation of Women's Clubs has a large number of libraries which are circulated among the residents of the State of Illinois in manner similar to the way in which the libraries are circulated by the Illinois Farmers' Institute, and

WHEREAS, The Illinois Federation of Women's Clubs has tendered to the Illinois Library Extension Board all of their libraries, now, therefore, be it

Resolved, that the Illinois Farmers' Institute tender all of its libraries to the Illinois Library Extension Board as soon as organized, and

Resolved, that the Legislative committee of the Illinois Farmers' Institute is hereby requested not to ask from our Legislature any appropriation for use of its library,

Resolved, that the Illinois Farmers' Institute hereby favors and urges the Legislature now in session to pass the act creating an Illinois Library Extension Board.

Resolution adopted.

Director Frake moved that Superintendent Hall be heard on the subject of needed legislation.

Motion adopted.

SUPERINTENDENT'S RECOMMENDATIONS.

In response to request for suggestions as to needed legislation for the better management of the Farmers' Institute of the State of Illinois, I beg leave to offer the following:

1. The director's approval should be made necessary in the fixing of the dates for the institutes of his district.
2. The director should have power to select all speakers that come from outside the county in which an institute is to be held. He should be given power to name and place upon the program as many such speakers as he may think advisable, provided the entire expense for the services of these speakers does not exceed one-third the amount appropriated by the State for defraying the expense of the institute.
3. No program for an institute should be printed at the expense of ths State that does not bear upon its face the approval of the director; and thie approval should be a necessary condition to the payment from the State treasury of any bills incurred.

4. The district round-up should be discontinued and the money heretofore devoted to these meetings should be used as compensation to the directors for the time given to institute work.

While the "circuit plan" that we have attempted this year has not been altogether a failure, it is true, however, that the Farmers' Institute has a superintendent who cannot superintend and directors who cannot direct. It is believed that the changes in the statute herein suggested, would give a properly "limited control by the central authority" and thereby reduce the cost and increase the efficiency of the institutes.

Respectfully submitted,

FRANK H. HALL.

On motion of Director Frake the report was received and ordered placed on file.

On motion a recess was taken to 1:45 o'clock p. m.

1:45 O'CLOCK P. M.

The board reconvened.

The consideration of the legislative committee's appropriation bill was taken up and adopted section by section, as follows:

A bill for an act making an appropriation for the Illinois Farmers' Institute and County Farmers' Institutes.

WHEREAS, To assist and encourage practical education among farmers, and for the developing of the agricultural resources of the State, the Thirty-ninth General Assembly created an organization under the name and style of the Illinois Farmers' Institute and entrusted to it the development of greater skill in the cultivation of crops, in the breeding and care of domestic animals, in dairy husbandry, in horticulture, in farm drainage, in improvement of highways and general farm management, through and by means of general discussions of these and kindred subjects, and practical instruction for improving the condition of the farmer by affording a better knowledge of successful agriculture; therefore to sustain the same,

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That there be, and is hereby appropriated to the Illinois Farmers' Institute the following sums, to-wit: For the salary of secretary, for clerk hire, typewriter, expressage, postage, office expenses, furniture, etc., the sum of four thousand five hundred dollars ($4,500) per annum for the fiscal years beginning July 1, 1905 and 1906.

§ 2. For the actual expenses of the members of the board of directors and officers of the Illinois Farmers' Institute in the performance of their duties as said members and officers, for the expenses of the State institute meeting and for the incidental expenses in promoting the development of the Farmers' Institute work throughout the State, the sum of seven thousand five hundred dollars ($7,500) per annum for the fiscal years beginning July 1, 1905 and 1906.

§ 3. For instructors at county farmers' institutes, the sum of three thousand dollars ($3,000) per annum for the fiscal years beginning July 1, 1905 and 1906.

§ 4. For the use of each county farmers' institute for the purpose of holding one or more county farmers' institute meetings in each county in the State, the sum of seventy-five dollars ($75.00) per annum for the fiscal years beginning July 1, 1905 and 1906, to be expended in such manner, under such rules and regulations as the board of directors of the Illinois Farmers' Institute may prescribe; said sum to be paid to the treasurer of each county farmers' institute, when such institute shall file with the secretary of the Illinois Farmers' Institute, a sworn statement which shall show that said county farmers' institute has held one or more duly advertised public sessions annually, of not less than two days each, at some easily accessible location, which shall include an itemized statement of the expenses of said meeting, with receipted vouchers therefor, a copy of its printed program, and a report of the proceedings showing the title and author of the papers read and by whom discussed, place or places of meeting, with average daily attendance, and such other information as may be called for by the Illinois Farmers' Institute and necessary to successfully assist this work.

§ 5. No officer nor officers of any county farmers' institute shall be entitled to receive any moneyed compensation whatever for any service rendered the same.

§ 6. That on the order of the president, approved by the director of the congressional district, the secretary of the State Farmers' Institute shall draw his warrant on the treasurer of the State Farmers' Institute, in favor of the treasurer of the county farmers' institute for the sum herein appropriated: *Provided*, that each warrant on account of a county farmers' institute shall show the county institute for whose benefit the same is drawn: *Provided further*, that the program and report of proceedings of the county farmers' institute, for which warrant is drawn, shall show that some of the following topics have been presented and discussed, viz.: Grain farming, stock feeding and breeding, dairy husbandry, orchard and small fruit culture, farmers' garden, domestic science and any subjects pertaining to farm life: *Provided, further*, that if the necessary expenses of a county farmers' institute shall not equal the sum of seventy-five dollars ($75.00) as aforesaid, then said warrant shall only be drawn for the sum expended.

§ 7. It shall be the duty of the treasurer of the Illinois Farmers' Institute to pay over to the treasurer of each county farmers' institute, the said sum of seventy-five dollars (75.00) or so much thereof as may be received for its use and benefit, as aforesaid, and make annual report to the Governor, as provided by law.

§ 8. The State Auditor is hereby authorized to draw his warrant for the sums herein specified and deliver the same to the treasurer of the Illinois Farmers' Institute upon his presenting voucher for same, signed by the president and secretary of said Illinois Farmers' Institute, and the State Treasurer shall pay the same out of any money in the State treasury not otherwise appropriated.

Director Frake offered the following resolution and moved its adoption:

Resolved, that the Legislative committee of the Illinois Farmers' Institute is hereby instructed to have the amended section six of the act of 1895 amended as follows:

First. By having the word and figures in said section six, viz., "their term of office to begin July 1, following their election", striken out.

Second. By having the words and figures in said section six, viz., "the salary of the secretary shall be two thousand dollars ($2,000) a year, payable in monthly installments", stricken out.

Third. By having the words and figures in said section six, viz., "The Auditor of Public Accounts is hereby authorized to draw his warrant on the State Treasurer monthly for the salary of the secretary of the Illinois Farmers' Institute, as herein provided, payable out of any funds in his hands not otherwise appropriated", striken out.

Resolution adopted.

On motion of Director Abbott, a recess of fifteen minutes was taken in order that the directors might call upon and pay their respects to Governor Deneen. The directors also examined the rooms offered to the Farmers' Institute by Secretary Rose.

Director Grout moved that the secretary be instructed to complete arrangements with Secretary Rose, in regard to the institute rooms.

Motion adopted.

Director Bayliss reported for the Committee on Agricultural Education as follows:

Your committee on Agricultural Education in the Public Schools beg leave to report that a very great and increasing interest in elementary instruction exists in the country schools; we believe that this interest is almost wholly due to the influence of this organization, and more than to any other one individual to the patient, persistent, skillful presentation of the subject at many county farmers' institutes by our efficient superintendent of institutes.

We believe, however, that very little is done in comparison with what might be done, because of the total lack of provision for the instruction of the older children in these schools. The possibility of improving the country schools in very many localities, at least, by consolidating small school districts and thus providing for a longer period in school, has been much debated. The public sentiment in favor of this proposal has steadily grown as the question has been discussed and studied; this thing is bound to come.

There is, however, some question as to whether the transportation of children to and from school is fully authorized by law, and believing that all doubt on this point ought to be removed, we respectfully submit that it would be wise for this body to instruct its Legislative committee to cause to to be prepared, introduced in the General Assembly, and advocated as one of the measures desired by this body, a bill providing for the necessary amendment of the school law, so that in any consolidated school district it shall be lawful for the directors when so ordered by the voters at a regular school election, to expend public money for such transportation.

Director Bayliss moved the adoption of the report and recommendation.

Motion adopted.

Director Bayliss, for the Committee on Agricultural Education reported further:

Your committee on Agricultural Education beg leave to report that the authorities of the University of Illinois, have included in their budget an item of $10,000 a year to enable them to establish and maintain a correspondence school in agriculture, along the lines heretofore advocated by this body.

We therefore recommend that our Legislative committee be instructed to coöperate in all possible ways with the university committee in obtaining this aid from the General Assembly.

We also recommend that in the event of the passage of said appropriation, your committee on Agricultural Education be informed as to the wishes of this body in regard to the plans for making said correspondence school most serviceable to the farmers of the State, and authorize us to present our views to the university authorities at the proper time, if so requested.

Director Bayliss moved the adoption of the report and recommendations.

Motion adopted.

Director Grout moved that the Legislative committee be authorized to ask for $5,000.00 for forestry investigations.

Motion adopted.

Director Davenport made verbal report of the appropriations to be asked for the experiment station.

Director Grout moved that the appropriation asked for soil investigations and experiments be endorsed and worked for by the institute.

Motion adopted.

Director Easterly moved that a committee of three be appointed to formulate a plan for a press bureau to promote institute interests.

Motion adopted.

The chair appointed Directors Easterly, Abbott and Davenport, as committee to formulate plans for press bureau.

The secretary made the following report of the amounts to the credit of the several funds:

Fund No. 1.	Office expenses	$ 892 13
2.	Salaries	1,374 86
3.	Libraries	2,101 80
4.	General expenses	469 30
6.	District institutes	436 63
7.	Domestic science	421 87
8.	Miscellaneous or contingent	1,000 00
		$6,690 59

On motion the report was referred to the finance committee.

A recess was taken to 8:00 o'clock p. m. at St. Nicholas Hotel.

ST. NICHOLAS HOTEL 8:00 O'CLOCK P. M.

Director Grimes reported for the finance committee as follows:

We the undersigned members of the finance committee beg leave to report that we recommend the transfer of one thousand dollars ($1,000.00) from the contingent fund to the general expense fund No. 4.

[Signed] EWD. GRIMES,
G. W. DEAN,
E. W. BURROUGHS.

Director Frake moved that the report be adopted and that the transfer as recommended be made. On call of the roll the motion was adopted. Ayes, 13; nays, 0.

Director Burroughs, chairman of the committee on Domestic Science asked to have read a letter received from Miss Sallie Anthony, secretary of the Illinois Association of Domestic Science, giving an account of their progress and work. On motion, the letter was received and placed on file.

Director Easterly for the special committee, reported as follows, and moved the adoption of the report:

Your committee appointed for the purpose of formulating a plan for organizing and conducting a press bureau, would respectfully beg leave to submit the following report:

1. Said bureau should be under the direct control of the legislative committee as to its organization and work.
2. Said bureau to consist of the secretary of the State Farmers' Institute and an experienced agricultural newspaper man whose duties shall be to collect suitable material bearing upon the various lines of legislation in which this association has interested itself, and to secure its publication in the newspapers of the State.

Respectfully submitted,
[Signed] H. G. EASTERLY,
A. N. ABBOTT.
Committee.

Report adopted.

Director Rossiter moved that the legislative committee be empowered to secure some newspaper man who has had experience as an agricultural writer to serve as a member of the press bureau, and have power to fix his compensation.

Motion adopted.

Director Easterly moved that Superintendent Hall be authorized to employ a reporter for the State meeting and that bids for the work be referred to him.

Motion adopted.

Director Rossiter asked for aid in holding institutes in Cook county congressional districts.

Director Schermerhorn moved that $75.90 be allowed to the seventh congressional district to hold a farmers' institute, and that Cook county be allowed to purchase seed corn for a corn growing contest.

Motion adopted.

On motion of Director Newman, a recess was taken till 11:00 o'clock a. m. Wednesday.

INSTITUTE ROOM, STATE HOUSE, WEDNESDAY 11 O'CLOCK A. M.

Legislative matters were discussed at some length.

Director Mann moved that Vol. IX of the Illinois Farmers' Institute Report be distributed upon the same basis as was Vol. VIII.

Motion adopted.

Director Mason offered the following resolution and moved its adoption:

WHEREAS, We regret the absence of our worthy president, Mr. B. F. Wyman, on account of the illness of his son, therefore

Resolved, That we tender to him our sincere sympathy in this time of distress, and hope for the speedy recovery of the afflicted son; that the secretary be directed to transmit a copy of this resolution to Mr. Wyman and his family.

Resolution adopted.

Approved March 7, 1905.

HOTEL MUNROE, JOLIET, ILL., Feb. 21, 1905.

The executive committee met at the above named time and place on call of President Wyman.

Those present were: President Wyman; Directors Frake, Schermerhorn, and Superintendent Hall.

Director Frake moved that 1,000 copies of the "Weekly Pantagraph" be sent to the county Farmers' Institute officers that they may have full reports of the State Institute Meeting.

Motion adopted.

Director Frake moved that the President and Secretary be authorized to draw warrants in the payment of bills for the expenses of the State Institute meeting at Joliet.

Motion adopted.

On motion the committee adjourned.

Approved March 7, 1905.

B. F. WYMAN,
President.

F. H. HALL,
Secretary.

INSTITUTE ROOM STATE HOUSE,
SPRINGFIELD, ILL.

The board of directors met at 10:00 A. M. Tuesday March 7th as per call of President Wyman.

Directors present on call of roll: Aldrich, Abbott, Burroughs, Cobb, Chester, Dean, Easterly, Frake, Grout, Grimes, Mann, Mason J. P. Mason S. B.. Newman, Reynolds, Rossiter, Schermerhorn, Sweet and Wyman; total 20.

The minutes of the previous meeting of the board of directors, January 24th 1905 were read and on motion of Director Grout, were approved as read.

The President asked the board to go into executive session and also requested all persons not members of the Board to retire from the room.

When the Board resumed open session, in the absence of a Secretary, on motion, Director Reynolds was made Secretary *protem.*

Director Abbott, chairman of the Legislative committee reported six bills introduced in the General Assembly viz., (1) regular Institute bill; (2) amended section 6 of bill creating Illinois Farmers' Institute; (3) Experiment Station bill; (4) consolidation of Schools; (5) Forestry bill, and (6) Stock Food bill. Mr. Abbott recommended that every member see his Senator and Representatives and urge the passage of the Institute bill.

Director Grimes moved that a committee of five be appointed to act with the legislative committee and call upon Secretary Rose for the purpose of explaining the matter of the item in appropriation bill in regard to printing.

Motion adopted.

President Wyman appointed the following named directors as members of such committee: Messrs Abbott, Grimes, Frake, Grout and Easterly.

On motion the Board took a recess until 1:30 o'clock p. m.

Chairman Frake of the committee appointed by the executive session of the board, reported by offering the following resolution and moved its adoption:

WHEREAS, It appears from statements made to this board by Secretary A. B. Hostetter that he is not in harmony with those principles which we consider are for the best interest of the Farmers' Institute, and

WHEREAS, We find that said Hostetter has used his efforts to defeat the policies of this board, and has uttered and published statements for the seeming purpose of bringing into public contempt members of this board, and

WHEREAS, By request of this board said Hostetter has tendered his resignation as secretary, be it

Resolved, that the resignation of A. B. Hostetter as secretary of this board be accepted, and that his resignation take effect immediately.

[Signed] F. I. MANN,
A. P. GROUT,
H. G. EASTERLY,
Committee.

Resolution unanimously adopted.

Director Frake moved that the secretary *pro tem* be instructed to send Mr. Hostetter a copy of the resolution accepting his resignation.

Motion adopted.

Director Frake moved that the secretary *pro tem* be instructed to notify the State Auditor of Public Accounts that Mr. Hostetter has tendered his resignation and that same has been accepted; that the amount due Mr. Hostetter for salary as secretary of the Illinois Farmers' Institute for the first seven days of March, 1905, is thirty-eight dollars and eighty-eight cents ($38.88).

Motion adopted.

Director Sweet, chairman of the Finance committee, offered the following report and moved its adoption:

To the Board of Directors of the Illinois Farmers' Institute:

GENTLEMEN—We, your Finance committee, beg leave to report that we have checked the books of the treasurer with the warrants paid and the stubs, with the books of the auditor and the secretary and find that the balance to the credit of each fund by the treasurer's accounts are as follows:

Warrant number.	To whom.	For what.	Fund number.	Amount.
3153	To Frank H. Hall	Postage for February	1	$ 1 58
3154	American Express Co.	Expressage	1	5 92
3155	Pacific Express Co.	do	1	4 50
3156	U. S. Express Co.	do	1	3 81
3157	Frank H. Hall	Salary as superintendent, for Feb	2	200 00
3158	H. A. McKeene	Salary as clerk, for Feb.	2	75 00
3159	Schnepp & Lauer Co	Printing and binding	3	6 00
3160	Herbert W. Mumford	Expenses State Institute	4	4 66
3161	Joseph Newman	Expenses as director	4	17 29
3162	C. G. Hopkins	Expenses State Institute	4	2 96
3163	Mrs. Joseph Carter	do	7	8 70
3164	Miss Sallie Anthony	do	7	9 05
3165	Western Union Tel. Co.	Messages	1	1 10
3166	J. B. Burrows, Decatur	Expenses State Institute	4	27 20
3167	E. Davenport	Expenses as director, State Inst.	4	3 41
3168	J. H. Coolidge	Espenses as director	4	15 65
3169	J. P. Mason	do	4	16 35
3170	J. P. Mason	do	4	15 82
3171	C. P. Reynolds	do	4	36 87
3172	J. H. Coolidge	do	4	16 50
3173	H. G. Easterly	do	4	19 15
3174	A. F. Moore	do	4	85 99
3175	Kane County Fr'rs Inst.	E. S. Bowdish, treas., Elburn	5	75 00
3176	DuPage Co. Fr'rs Inst.	L. S. Hill, treas., Aurora	5	75 00

Approved March 8, 1904.

3177	To Ralph Allen	Expenses as director	4	$15 36
3178	A. N. Abbott	do	4	18 16
3179	Israel Mills	do	4	31 45
3180	G. W. Dean	do	4	13 75
3181	S. B. Mason	do	4	7 05
3182	The Pantagraph	For copies of paper	4	29 25
3183	B. F. Wyman	Expenses as director	4	42 47
3184	H. D. Hughes	do	4	22 96
3185	John M. Clark	do	4	14 75
3186	A. V. Schermerhorn	do	4	16 02
3187	E. N. Cobb	do	4	15 53
3188	E. N. Cobb	do	4	15 85
3189	E. W. Burroughs	do	4	31 10
3190	Frank H. Hall	Expenses as superintendent	4	13 77
3191	11th Cong. District	J. W. Patterson, treas., Plainfield.	6	50 00
3192	Moultrie County Farmer's Institute	Dr. J. L. Bone, Bethany	5	66 50

Approved March 9, 1904.

Warrant number.	To whom	For what.	Fund number.	Amount.
3193	To F. C. Rossiter	Expenses as director	4	$21 35
3194	Joseph Newman	..do	4	19 55
3195	F. I. Mann	..do	4	26 03
3196	Miss Sallie Anthony	Expenses Ill. Ass'n Dom. Science	7	9 00
3197	B. R. Pierce	Expenses as director	4	27 00
3198	DeWitt County Farmer's Institute	Fred Zeigler, treas., Clinton	5	65 48

Approved March 17, 1904.

3199	To Adams Express Co	Expressage	1	$ 5 32
3200	American Express Co	..do	1	7 13
3201	John Underfanger	Freight and drayage	1	3 42
3202	Coe Brothers	Stationery, etc	1	4 55
3203	Ed. F. Hartmann Co	Printing	1	104 75
3204	Central Union Tel. Co	Toll service	1	2 10
3205	H. A. McKeene	Salary for March	2	83 33
3206	Schnepp & Lauer Co	Printing	3	3 70
3207	A. C. McClurg & Co	Library books	3	12 43
3208	W. A. Henry	Books for library	3	13 75
3209	Frank Simmons	..do	3	23 75
3210	A. V. Schermerhorn	Expenses as director	4	8 84
3211	J. K. Dickirson	..do	4	24 88
3212	J. P. Mason	..do	4	18 70
3213	S. Noble King	..do	4	11 68
3214	Ralph Allen	..do	4	3 76
3215	Wilber P. Snare	Expenses attending 16th dist. con.	4	2 89
3216	A. W. Bryant	..do	4	7 44
3217	Wm. West	..do	4	1 00
3218	A. T. Doerr	Seed corn	4	15 00
3219	John R. Clisby	..do	4	19 00
3220	Violet Bourne	Stenographer State Institute	4	9 25
3221	Ira Cottingham	Photos of institute charts	4	10 00
3222	Shelby Co. Farmers' Inst	W. S. Middlesworth, treas	4	75 00

Approved April 4, 1904.

3223	To Frank H. Hall	Postage and printing	1	$ 6 65
3224	United States Express Co	Expressage	1	1 38
3225	Western Union Tel. Co.	Messages	1	95
3226	Pacific Express Co	Expressage	1	2 90
3227	Springfield Trunk Co	Library cases	3	30 00
3228	John Underfanger	Freight and drayage	1	2 34
3229	Frank H. Hall	Expenses as superintendent	4	30 13
3230	A. P. Grout	Expenses 20th dist. conference	4	35 60
3231	Edward Grimes	Expenses as director	4	13 55
3232	E. C. Richards	Expenses 21st dist. conference	4	4 76
3233	R. E. Chiles	..do	4	2 95
3234	Wm. Lowis	..do	4	4 45
3235	B. F. Workman	..do	4	2 35
3236	Kankakee Co. F'rms Inst	L. W. Smith, treas., Manteno	5	75 00

Approved April 11, 1904.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3237	Menard Co. Farmer's Inst.....	J. M. Johnson, Treas., Petersburg, Ill..........	5	$ 51 30
3238	John Underfanger	Freight & drayage	1	3 74
3239	Schnepp & Lauer Co	Printing 5M memo books..........	3	22 50
3240	A. C. McClurg & Co	Balance account...........	3	1 55
3241	Frank Simmons	340 library books	3	262 45
3242	John Newman Co	50 library books	3	37 50
3243	E. E. Chester	5 bushels seed corn	4	10 00
3244	Leigh Maxcy................	9 bushels seed corn	4	18 00
3245	F. A. Warner	5 bushels seed corn	4	12 50
3246	B. F. Wyman...............	..do..........	4	12 50
3247	B. F. Wyman...............	Expenses as director............	4	13 16
3248	Alonzo Stancil, Yorkville	12th district conf............	4	1 75
3249	B. A. Williams, Sycamore....	..do..........	4	3 20
3250	D. M. Terry, Earlville	..do..........	4	3 95
3251	Wm. M. Neely, Pecatonica ..	..do..........	4	6 20
3252	G. W. Dean, Adams	15th district conf............	4	11 00
3253	J. F. Lattimer, Abingdon	..do..........	4	1 06
3254	R. J. McCahon, Orion.........	..do..........	4	2 36
3255	M. T. Lee, Sterling...........	13th district conf............	4	1 45
3256	Fred A. Lawton, Dixon	..do..........	4	75
3257	H. M. Phillips, Lena	..do..........	4	3 48
3258	G. N. Melendy, Thompson..	..do..........	4	3 55
3259	W. J. Huston, Rochelle	..do..........	4	2 12
3260	A. B. Hostetter...............	Expenses as secretary	4	20 88
3261	James Frake.................	Expenses as director.............	4	11 42

Approved May 3, 1904.

3262	Paine & Barnes...............	Printing envelopes	1	$ 2 00
3263	H. A. McKeene...............	Salary for month of April..........	2	83 33
3264	A. B. Hostetter...............	Postage and office supplies	1	11 50
3265	A. H. Yannaway	18th district conf	4	7 90
3266	D. Brumback	..do..........	4	5 20
3267	C. W. Curl..................	..do..........	4	2 65
3268	E. J. Viall	..do..........	4	6 71
3269	F. I Mann	..do..........	4	5 20
3270	A. V. Schermerhorn	23d district conf	4	6 90
3271	Richard Whittle.............	..do..........	4	6 30
3272	J. W. Jaquess	..do..........	4	4 10
3273	A. J. Moss	..do..........	4	6 95
3274	Will Leckrone...............	..do..........	4	3 30
3275	R. H. Vanderhoof............	..do..........	4	2 05
3276	J. M. Hollingsworth	..do..........	4	6 08
3277	Peter Beever............	..do..........	4	8 60
3278	E. E. Chester	Total expenses 19th district conf..	4	29 11

Approved May 3, 1904.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3279	To Jasper Co. Farmers' Inst..	W. F. Kibler, treas., R. F. D. Newton,	5	$52 35
3280	Capitol Carpet Cle'n'g Co.	Cleaning rugs	1	2 00
3281	American Express Co.	Express, etc	1	2 85
3282	Pacific Express Co	..do	1	40
3283	Edw. F. Hartmann Co.	Printing and stamped envelopes..	1	25 00
3284	Frank H. Hall	Postage	1	2 50
3285	A. B. Hostetter	..do	1	17 50
3286	Schnepp & Lauer	Postal cards and printing	3	3 25
3287	Marion E. Garmory	Reporting State Institute	4	90 20
3288	Schnepp & Lauer	5,500 bags and labels	4	53 25
3289	E. W. Burroughs	Expenses, 22nd Cong., dist. conf..	4	6 40
3290	E. P. Seibert	..do	4	4 60
3291	Geo. Grube	..do	4	3 90
3292	Mahlon Hartman	..do	4	2 80
3293	John G. Schneider	..do	4	2 75
3294	Frank E. Culp	..do	4	2 30
3295	H. G. Easterly	Expenses as director	4	31 20
3296	W. A. Bain	Expenses, 25th dist. conference...	4	4 40
3297	Cyrille A. Marchildon	..do	4	5 40
3298	M. N. Swan	..do	4	1 85
3299	E. R. Jinnette	..do	4	4 56
3300	W. H. Leidigh	..do	4	4 82
3301	Israel Mills	Total expenses, 24th dist. conf....	4	40 85
2302	Frank H. Hall	Expenses as superintendent	4	54 19

Approved May 27, 1904.

3303	To John Underfanger	Freight and drayage	1	$ 4 26
3304	The Schnepp & Lauer Co.	2,000 booklets	3	9 00
3305	R. E. Worrel	Expenses, 14th dist. conference...	4	4 90
3306	C. L. Merriam	..do	4	3 63
3307	Alvah Jay	..do	4	2 85
3308	J. W. Linkham	..do	4	1 61
3309	E. N. Cobb	..do	4	2 50
3310	C. R. A. Marshall	..do	4	1 70
3311	H. D. Hughes	Expenses as director	4	30 67
3312	A. V. Schermerhorn	..do	4	13 58
3313	Hancock Co. Farm'rs Inst.	W. A. Moore, treas., Carthage ...	5	8 28

Approved May 23, 1904.

3314	A. B. Hostetter	Postage and sundries	1	$ 6 55
3315	Edw. F. Hartmann Co	Envelopes and postage	1	18 00
3316	H. A. McKeene	Salary for May, 1904	2	83 33
3317	Coe Brothers	Office supplies	3	95 15
3318	Israel Mills	Expenses as director	4	10 50
3319	H. G. Easterly	..do	4	31 59

Approved June 3, 1904.

3320	American Express Co	Expressage	1	$ 11 17
3321	Pacific Express Co	..do	1	13 03
3322	Frank H. Hall	Postage	1	2 78
3323	A. B. Hostetter	Directory, etc	1	13 70
3324	Frank H. Hall	Salary to July 1	2	200 00
3325	Frank H. Hall	Expenses district conference	4	19 73
3326	Frank H. Hall	..do	4	13 36
3327	B. F. Wyman	Expenses as director	4	13 48

Approved June 13, 1904.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3328	United States Express Co.	Expressage	1	$ 9 95
3329	W. G. Griffith	5 bushels seed corn	4	12 50
3330	J. P. Mason	Expenses as director	4	8 05
3331	A. N. Abbott	..do	4	6 16
3332	Sallie Anthony	Secretary Domestic Science	7	324 34

Approved June 23, 1904.

3333	J. C. Nevins	Treasurer Adams Co. Institute	5	$75 00
3334	American Express Co	Expressage	1	76 18
3335	United States Express Co.	..do	1	51 03
3336	Pacific Express Co.	..do	1	17 27
3337	Johnston & Hatcher	Supplies	1	1 65
3338	Coe Brothers	Neostyle supplies	1	3 45
3339	A. B. Hostetter	Postage	1	30 00
3340	H. A. McKeene	Salary for June, 1904	2	83 33
3341	E. E. Chester	Expense as director	4	63 07
3342	Richard J. Dickinson	Attending district conference	4	1 90
3343	H. E. Johnson	..do	4	3 50

Approved July 5, 1904.

3344	Adams Express Co	Expressage	1	$101 51
3345	American Express Co.	..do	1	22 33
3346	John Underfanger	Drayage	1	50
3347	Schnepp & Laurer Co	Making account book	1	10 00
3348	Frank H. Hall	Postage	1	4 34
3349	H. A. McKeene	Salary for July	2	83 33
3350	Frank Simmons	Library books	3	33 50
3351	Edw. F. Hartmann Co	Roster cards, etc	1	48 00
3352	B. F. Wyman	Expense as director	4	21 44
3353	Frank H. Hall	Expense as superintendent	4	12 72
3354	A. V. Schermerhorn	Expense as director	4	14 72
3355	Schnepp & Lauer Co.	Printing bulletin, etc	1	84 70
3356	Mrs. S. Noble King	Expense Domestic Science	7	11 47

Approved Aug. 3, 1904.

3357	Coe Brothers	Neostyle supplies	1	$15 00
3358	Adams Express Co	Expressage	1	7 97
3359	Pacific Express Co	..do	1	7 15
3360	United States Express Co.	..do	1	4 27
3361	John Underfanger	Freight and drayage	1	1 05
3362	H. A. McKeene	Salary for August	2	83 33
3363	A. B. Hostetter	Package aluminum and postage	1	3 15
3364	Schnepp & Lauer	Rebinding books	3	9 60
3365	American Book Co	Books for library	3	7 20
3366	W. J. Horn Co	Materials for repairing libraries	3	3 25
3367	Springfield Trunk Co	..do	3	1 85
3368	W. E. Braden	Expenses attending district con.	4	3 55

Approved Sept. 1, 1904.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3369	Edwd. F. Hartman Co	Printing and postage	1	$90 50
3370	Am. Express Co	Expressage	1	5 67
3371	Schnepp & Lauer Co	Printing	1	6 25
3372	T. E. Orr	Electros for report	1	2 25
3373	A. B. Hostetter	Postage	1	5 00
3374	Houghton, Mifflin Co	Library books	3	10 00
3375	Harper Brothers	..do	3	17 41
3376	Macmillan Co	..do	3	18 80
3377	Am. Book Co	..do	3	3 20
3378	Bobbs-Merrill Co	..do	3	12 50
3379	Chas. Scribner's Sons	..do	3	20 37
3380	Edward Grimes	Expenses as director	4	19 96

Approved Sept. 8, 1904.

3381	Henson Robinson Co	Supplies for repairs	3	$ 1 30
3382	Harper Bros	10 vols. library books	3	6 90
3383	Frank Simmons	385 vols. library books	3	294 58
3384	Schnepp & LauerCo	Library record book, etc	3	11 25
3385	Frank H. Hall	Postage	1	5 50
3386	John Underfanger	Freight and drayage	1	8 25
3387	U. S. Express Co	Expressage	1	5 84
3388	Pacific Express Co	..do	1	2 45
3389	Adams Express Co	..do	1	9 49

Approved Sept. 22, 1904.

3390	Phillips Bros	Halftones for annual report	1	$ 14 00
3391	A. B. Hostetter	Postage	1	9 00
3392	H. A. McKeene	Salary for September	2	83 33
3393	Clarkson & Mitchell	Formaldehyde	3	55
3394	Frank Simmons	Library books. 50 vols	3	122 52

Approved Oct. 3, 1904.

3395	A. B. Hostetter	Membership fee, A. A. I W	1	$ 5 00
3396	Am Express Co	Expressage	1	3 77
3397	Pacific Express Co	..do	1	77
3398	U. S. Express Co	..do	1	5 62
3399	Edwd. F. Hartmann Co	Printing, etc	1	54 60
3400	M. K. Weems & Co	Towel supply	1	1 50
3401	Schnepp & Laurer	Printing	1	5 00
3402	A. B. Hostetter	Postage, etc	1	7 45
3403	H. A. McKeene	Salary for October	2	83 33
3404	Geo. W. Harnett	Material for repairs on library	3	2 65
3405	A. B. Hostetter	Subscription to Bookman	3	2 00
3406	E. N. Cobb	Expense as director	4	36 79
3407	Tazewell County Institute	John Slonneger, treasurer	5	75 00
3408	16th Dist. Institute	..do	6	50 00
3409	Hancock County Institute	W. A. Moore, treasurer	5	38 46

Approved Oct. 31, 1904.

Warrant number.	To whom paid.	For what.	Fund number.	Amount.
3410	Edw. F. Hartmann Co	Printing	1	$60 50
3411	A. B. Hostetter	Postage	1	3 00
3412	L. S. Dickey & Co	Library books, 11 vols	3	16 50
3413	J. W. Diller	Library books, 50 vols	3	16 50
3414	Geo. W. Dean	Expenses as director	4	17 95
3415	B. F. Wyman	do	4	24 10
3416	A. B. Hostetter	Expenses to board meeting	4	23 00
3417	J. K. Dickirson	do	4	18 35
3418	Cumberland Co. inst	G. C. Duensing, treas	5	75 00
3419	Champaign Co. inst	Z. R. Genung, treas	5	60 70
3420	Cass Co. inst	J. E. Edwards, treas	5	75 00
3421	Morgan Co. inst	H. G. Keplinger, treas	5	64 20
3422	Eighteenth Cong. inst	G. C. Duensing, treas	6	39 58

Approved Nov. 4, 1904.

3423	Adams Express Co	Expressage	1	$ 2 90
3424	American Express Co	do	1	5 03
3425	Pacific Express Co	do	1	3 77
3426	U. S. Express Co	do	1	2 34
3427	Western Union Telegraph Co	Messages	1	81
3428	Frank H. Hall	Salary as Supt. of institutes	2	214 28
3429	Frank H. Hall	Expenses as Supt. of institutes	4	68 26
3430	Wayne county inst	D. K. Davis, Fairfield, treas	5	57 66
3431	Lawrence county inst	Wm. Neal, Lawrenceville, treas	5	61 25
3432	Franklin county inst	M. H. Akin, treas	5	75 00
3433	Edwards county inst	M. E. Shurtleff, Bone Gap, treas.	5	70 55

Approved Nov. 5, 1904.

3434	Massac county institute	F. J. McCartney, treas	5	$75 00
3435	Schnepp & Lauer Co	Printing, etc	1	6 60
3436	A. B. Hostetter	Postage	1	2 00
3437	Springfield Trunk Co	Library cases (10)	3	35 00
3438	Frank Simmons	Library books	3	13 50
3439	Joseph Newman	Expenses as director	4	28 35
3440	Euclid N. Cobb	do	4	20 73
3441	Mrs. S. Noble King	Del. to meet'g, A.A.F.I.W., St. L	7	11 45
3442	Mrs. S. Noble King	Postage, Ill. Ass'n. Dom. Science	7	6 50

Approved Nov. 14, 1904.

3443	John Underfanger	Freight and drayage	1	$ 9 33
3444	A. B. Hostetter	Postage	1	6 00
3445	H. A. McKeene	Salary for November	2	83 33
3446	MacMillan Co	Library books	3	3 50
3447	E. W. Burroughs	Expenses as director	4	35 55
3448	H. G. Easterly	do	4	32 92
3449	Israel Mills	do	4	17 89
3450	S. B. Mason	do	4	10 90
3451	Wabash county inst	J. W. Jaquess, treas	5	75 00
3452	Henderson county inst	Cecil Brooks, treas	5	75 00
3453	Mercer county inst	F. T. Duncan, treas	5	72 23
3454	Hardin county inst	Edward Schneider, treas	5	57 00
3455	Pulaski county inst	W. A. Lackey, treas	5	65 67
3456	Bond county inst	John Stanton, treas	5	23 23
3457	Williamson county inst	A. M. Tounsend, treas	5	54 30
3458	14th Cong. Dist. inst	Cecil Brooks, treas	6	16 32

Approved Dec. 5, 1904.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3459	C. M. Simmons, treasurer	Pike County Institute	5	$60 68
3460	R. T. Higgins, treasurer	Fayette County Institute	5	75 00
3461	C. H. Burnett, treasurer	Saline County Institute	5	75 00
3462	H. R. Logan, treasurer	Douglas County Institute	5	74 57
3463	J. Earl Kincaid, treasurer	Menard County Institute	5	75 00
3464	Wm. H. Grisson, Jr., treas	Johnson County Institute	5	54 50
3465	J. B. Hale, treasurer	Gallatin County Institute	5	75 00
3466	Adams Express Co	Expressage	1	13 56
3467	American Express Co	do	1	12 07
3468	U. S. Express Co	do	1	6 29
3469	Coe Brothers	Neostyle supplies	1	4 95
3470	Phillips Bros	1 half-tone cut	1	4 50
3471	Western Union Tel. Co	Message	1	25
3472	Weems Laundry	Toilet supply	1	1 20
3473	Edw. F. Hartmann Co	Printing programs, etc	1	55 40
3474	A. N. Abbott, director	Expenses	4	50 82
3475	H. D. Hughes, director	do	4	24 96
3476	Israel Mills, director	do	4	8 88
3477	Ralph Allen, director	do	4	24 12
3478	B. F. Wyman, director	do	4	11 54
3479	James Frake, director	do	4	22 40
3480	A. B. Hostetter, secretary	Expenses, committee meeting	4	17 00
3481	Frank Simmons	Library books	3	14 30
3482	Schnepp & Lauer Co	Binding, printing and postage	3	23 70
3483	Sallie Anthony, secretary	Services and postage	7	45 00
3484	Mrs. S. Noble King	Expenses, domestic science	7	7 18
3485	Thos. McClanahan	Warren County Institute		56 67

Approved Dec. 6, 1904.

3486	Frank Britton, treasurer	Richland County Farmers' Inst	5	$ 75 00
3487	J. T. Holtslaw, treasurer	Jefferson County Farmers' Inst	5	75 00
3488	Harvey N. Ames, treasurer	Coles County Farmers' Institute	5	75 00
3489	J. J. Boyd, treasurer	Union County Farmers' Institute	5	59 72
3490	Thomas Sullivan, treasurer	McDonough Co. Farmers' Inst	5	75 00
3491	. L. Miller, treasurer	Jackson County Farmers' Inst	5	64 36
3492	W. W. Wilbourne, treasurer	Alexander County Farmers' Inst	5	66 60
3493	T. J. Priest, treasurer	Scott County Farmers' Institute	5	75 00
3494	Miss Caroline Donaldson	Mason County Farmers' Institute	5	75 00
3495	E. M Husted, treasurer	Greene County Farmers' Inst	5	75 00
3496	Edward Grimes, treasurer	Montgomery Co. Farmers' Inst	5	75 00
3497	D. S. Dalbey, treasurer	Jersey County Farmers' Institute	5	71 50
3498	W A. Kugler, treasurer	Washington Co Farmers' Inst	5	75 00
3499	W. A. Kugler, treasurer	22d Congressional District Inst	6	39 73
3500	Pacific Express Co	Expressage	1	1 27
3501	Clarkson & Mitchell	Disinfectant	1	1 20
3502	Schnepp & Lauer	Printing	1	4 50
3503	A. B. Hostetter	Postage and desk supplies	1	5 00
3504	Frank H. Hall	Salary	2	214 28
3405	Schnepp & Lauer	Printing and binding	3	6 10
3406	Frank H. Hall	Expenses as superintendent	4	54 84
3507	E. N. Cobb	Expenses as director	4	20 62
3508	Edward Grimes	do	4	16 02
3509	F. I. Mann	do	4	33 21
3510	A. V. Schermerhorn	do	4	52 29

Approved Dec. 16, 1904.

3511	A. B. Hostetter	Postage	1	$ 5 00
3512	H. A. McKeene	Salary for December	2	83 33
3513	F. H. Revell Co	Library books, 10 vols	3	13 50
3414	Doubleday, Page & Co	Library books, 60 vols	3	62 57
3515	Orange Judd Co	Library books, 11 vols	3	14 45
3516	Geo. J. Hersman, treasurer	Brown County Farmers' Instiiute	5	66 62
3517	W. H. Ashdown, treasurer	Rock Island Co. Farmers' Inst	5	75 00
3518	J. N. Upton, treasurer	Hamilton County Farmers' Inst	5	75 00
3519	W. R. Parliman, treasurer	Randolph County Farmers' Inst	5	75 00
3520	John Zeter, treasurer	Logan County Farmers' Institute	5	75 00
3521	Jos. Heimann, treasurer	Clinton County Farmers' Inst		74 87
3522	Thos. S. Marshall, treasurer	Marion County Farmers' Inst		75 00

Approved Dec. 22, 1904.

Warant number.	To whom.	For what.	Fund number.	Amount.
3523	L. H. Coleman, treasurer	Sangamon County Institute	5	$ 75 00
3524	B. F. Wyman, treasurer	DeKalb County Institute	5	75 00
3525	W. T. White, treasurer	Perry County Institute	5	75 00
3526	W. H. Kibler, treasurer	Jasper County Institute	5	75 00
3527	W. H. Kibler, treasurer	23d Congressional Institute	6	50 00
3528	L. F. Taylor, treasurer	Crawford County Institute	5	74 20
3529	Geo. L. Aderton, treasurer	Calhoun County Institute	5	75 00
3530	Geo. L. Aderton, treasurer	20th Congressional Institute	6	50 00
3531	W. F. Scott, treasurer	Effingham County Institute	5	68 68
3532	Chas. C. Benner, treasurer	Macoupin County Institute	5	75 00
3533	E. A. Vandiveer, treasurer	Christian County Institute	5	75 00
3534	E. A. Vandiveer, treasurer	21st Congressional Institute	6	50 00
3535	P. M. Rindesbacher, treasurer	JoDaviess County Institute	5	75 00
3536	Fred Richardson, treasurer	Lee County Institute	5	75 00
3537	C. S. Hays, treasurer	Clay County Institute	5	75 00
3538	C. S. Hays, treasurer	24th Congressional Institute	6	35 18
3539	U. S. Express Co	Expressage	1	1 83
3540	American Express Co	do	1	18 26
3541	Pacific Express Co	do	1	3 40
3542	M. K. Weems & Co	Towel supply	1	60
3543	John Underfanger	Drayage	1	35
3544	Edward F. Hartman Co	Programs, county institutes	1	30 00
3545	Frank H. Hall	Salary as superintendent	2	214 38
3546	Houghton Mifflin Co	Library books, 40 vols	3	26 57
3547	D. Appleton & Co	Library books, 10 vols	3	9 00
3548	A. C. McClurg & Co	Library books, 22 vols	3	21 66
3549	Dodd, Mead & Co	Library books, 20 vols	3	31 50
3550	Schnepp & Laurer	Rebinding books	3	2 10
3551	American Book Co	Library books, 1 vol	3	1 14
3552	Harper Bros	Library books, 20 vols	3	15 45
3553	Coe Bros	Library books, 31 vols	3	32 00
3554	J. W. Diller	Library books, 14 vols	3	6 10
3555	Frank Simmons	Library books, 36 vols	3	58 80
3556	Edward Grimes	Expenses as director	4	22 33
3557	Merrill K. Sweet	do	4	15 00
3558	Frank H. Hall	Expenses as superintendent	4	41 22

Approved Jan. 24, 1905.

3559	Adams Express Co	Expressage	1	$ 4 99
3560	Western Union Tel. Co	Telegrams	1	86
3561	A. B. Hostetter	Postage	1	7 00
3562	E. W. Burroughs	Expenses as director	4	31 49
3563	B. F. Wyman	do	4	33 67
3564	C. P. Reynolds	do	4	15 00
3565	A. B. Hostetter	Expenses as secretary	4	3 00
3566	Wm. Ditman, treasurer	Clark County Institute	5	75 00
3567	C. P. Tune, treasurer	Pope County Institute	5	37 38
3568	C. W. Mitchell, treasurer	Whiteside County Institute	5	75 00
3569	Merrill K. Sweet, treasurer	Cook County Institute	5	75 00
3570	Merrill K. Sweet, treasurer	7th Congressional Dist. Institute	6	33 06
3571	C. Kolmer, treasurer	Monroe County Institute	5	73 71
3572	Cecil Brook, treasurer	14th Congressional Dist. Institute	6	5 50
3573	Funk & Wagnalls	Library books, 10 vol	3	3 00
3574	A. Flanagan & Co	60 vol. library books	3	23 60
3575	Star Pub Co.	10 vol. library books	3	9 00
3576	A. C. McClurg & Co	31 vol. library books	3	32 78
3577	Doubleday, Page & Co.	30 vol. library books	3	28 63
3578	Charles Scribners' Sons	45 vol. library books	3	30 85
3579	A. C. McClurg & Co	20 vol. library books	3	25 00
3580	John Newman Co	20 vol. library books	3	13 50
3581	Educational Pub. Co.	45 vol. library books	3	20 80
3582	Lathrop, Lee & Shepherd	10 vol. library books	3	8 40
3583	Houghton, Mifflin & Co.	10 vol. library books	3	8 34
3584	Dodd, Mead & Co.	10 vol. library books	3	9 35
3585	Ginn & Co	10 vol. library books	3	6 25
3586	Harper Bros.	20 vol. library books	3	15 84
3587	Bobbs, Merrill Co.	10 vol. library books	3	12 50
3588	Little, Brown & Co.	10 vol. library books	3	7 42
3589	The MacMillan Co.	40 vol. library books	3	37 51
3590	The Century Co	10 vol. library books	3	15 00
3591	L. C. Page & Co.	10 vol. library books	3	13 33
3592	Orange Judd Co.	44 vol. library books	3	40 43
3593	The Schnepp & Lauer Co.	Postals for library use	3	4 50
3594	A. B. Hostetter	Expenses acct. library	3	6 25

Approved Jan. 18, 1905.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3595	W. J. Wolford, treasurer	Vermilion County Institute	5	$45 85
3596	C. P. Tune, treasurer	Pope County Institute	5	19 09
3597	Henry Lichtenberger	Macon County Institute	5	75 00
3598	G. H. Mason, treasurer	Woodford County Institute	5	75 00
3599	W. G. Harlow, treasurer	McLean County Institute	5	75 00
3600	H. A. McKeene	Salary for January	2	83 33
3601	A. W. Mumford	10 vol. library books	3	8 00
3602	Springfield Trunk Co	Library cases	3	30 00
3603	George Shawver	Attd. dist. conference	4	4 55
3604	A. B. Hostetter	Expenses as secretary	4	11 95
3605	A. P. Grout	Expenses as director	4	92 78
3506	E. Davenport	..do	4	10 08
3607	F. I. Mann	..do	4	18 44

Approved Jan. 24, 1905.

3608	A. B. Hostetter	Postage	1	$30 00
3609	S. B. Mason	Expenses as director	4	17 59
3610	H. G. Easterly	..do	4	43 85
3611	Edward Grimes	..do	4	6 26
3612	E. W. Burroughs	..do	4	14 00
3613	Joseph Newman	..do	4	21 20

Approved Jan. 25, 1905.

3614	M. K. Weems & Co	Towel supply	1	$ 0 60
3615	Chas. Scribner's Sons	Library books	3	4 63
3616	A. N. Abbott	Expenses as director	4	72 47
3617	A. V. Schermerhorn	..do	4	14 45
3618	Ralph Allen	..do	4	14 84
3619	Mrs. S. Noble King	Expenses domestic science	7	15 40
3620	B. W. Crum, treasurer	Stark County Institute	5	58 06
3621	A. C. Gable, treasurer	Kendall County Institute	5	75 00
3622	John T. Mortimore, treasurer	Livingston County Institute	5	75 00
3623	John T. Mortimer, treasurer	17th Congressional Institute	6	16 29
3624	Winfred Zeigler, treasurer	DeWitt County Institute	5	75 00
8625	F. B. Walker, treasurer	Stephenson County Institute	5	75 00
8626	John Simpson, treasurer	Carroll County Institute	5	75 00

Approved Feb. 4, 1905.

3627	J. W. Patterson, treasurer	Will County Institute	5	$ 75 00
3628	D. A. Taylor, treasurer	Ford County Institute	5	75 00
3629	Frank E. Culp, treasurer	Madison County Institute	5	75 00
3630	L. S. Hill, treasurer	DuPage County Institute	5	75 00
3631	American Express Co	Expressage	1	14 34
3632	Pacific Express Co	..do	1	4 18
3633	Edward F. Hartmann Co	Printing programs, etc	1	15 50
3634	Frank H. Hall, superintendent	Salary for January	2	214 28
3635	Frank Simmons	Library books	3	2 50
3636	Frank H. Hall	Expenses as superintendent	4	44 20
3637	J. P. Mason	Expenses as director	4	31 90
3638	James Frake	..do	4	14 24

Approved Feb. 6, 1905.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3639	United States Express Co	Expressage	1	$ 5 90
3640	A. B. Hostetter	Postage	1	5 00
3641	Geo. W. Dean	Expenses as director	4	16 26
3642	John Wertman, treasurer	Fulton County Institute	5	75 00
3643	W. C. Bryant, treasurer	Bureau County Institute	5	75 00
3644	Owen Cottingham, treasurer	Peoria County Institute	5	68 53

Approved Feb. 11, 1905.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3645	Mrs. John Shields, treas	Marshall Co. Inst	5	$51 05
3646	Adams Express Co	Expressage	1	12 25
3647	Dodd's Commercial Ptg	Printing credentials	1	3 00
3648	Schnepp & Lauer	Printing	1	11 50
3649	A. B. Hostetter	Ill. State Lib. Fee	3	1 00
3650	Springfield Trunk Co	Library cases, 10	3	30 00
3651	Frank Simmons	Library books	3	2 47
3652	Rand McNally & Co	Library books	3	11 00
3653	A. N. Abbott	Expenses as director	4	17 19
3654	Ralph Allen	do	4	20 43

Approved Feb. 15, 1905.

Warrant number.	To whom.	For what.	Fund number.	Amount.
3655	Daniel Berry, treas	White Co. Inst	5	$63 40
3656	O. L. Gray, treas	Iroquois Co. Inst	5	75 00
3657	W. A. Moore, treas	Hancock Co. Inst	5	31 87
3658	Francis Dresser, treas	Ogle Co. Inst	5	75 00
3659	Francis Dresser, treas	13th Cong. Dist. Inst	6	50 00
3660	E. M. Breckenridge, treas	Winnebago Co. Inst	5	75 00
3661	J. L. Barber, treas	La Salle Co. Inst	5	75 00
3662	J. L. Barber, treas	12th Cong. Dist. Inst	6	50 00
3663	J. W. Dysart, treas	Putnam Co. Inst	5	74 68
3664	The Schnepp & Laurer Co	Ptg. Stamped envelopes	1	19 25
3665	A. B Hostetter	Postage	1	10 00
3666	American Book Co	11 lib. Books	3	4 95
3667	The A. I. Root Co	10 vol. lib. books	3	8 00
3668	Educational Pub. Co	16 vol. lib. books	3	11 03
3669	Edward F. Hartman Co	Printing	1	20 00
3670	Wm. S. Middlesworth	Shelby Co. Inst	5	75 00
3671	W. W. Royer, treas	Piatt Co. Inst	5	75 00
3672	Samuel Devere, treas	Kankakee Co. Inst	5	75 00
3673	M. S. Vaughn, treas	Moultrie Co. Inst	5	75 00
3674	Wm. S. Middlesworth, treas	19th Cong. Inst	6	33 38

Approved Feb. 20, 1905

Warrant number.	To whom.	For what.	Fund number.	Amount.
3675	Wm. Dietrich	Instructor State Institute	4	$12 73
3676	O. J. Kern	do	4	37 75
3677	Joliet Printing Co	Printing for State Institute	4	16 50
3678	The News Co	Half-tones, etc	4	14 15
3779	L. D. Harvey	Instructor State Institute	4	82 82
3680	Martha VanRensselaer	do	4	70 20
3681	Anna Barrows	Instructor Domestic Science	7	94 00
3682	Isabel Bevier	do	7	13 68
3683	Mrs. S. N. King	Expenses State Institute	7	9 70
3684	Sallie Anthony	Expenses D. S. association	7	32 25
3685	Mrs. J. R. Challacombe	Instructor State Institute	7	15 00
3686	Miss Sallie Anthony	Expenses, secretary D. S. ass'n	7	9 60
3687	John W. Lloyd	Instructor State Institute	4	13 35
3688	Prof. S. A. Forbes	do	4	9 67
3689	Prof. A. J. Glover	do	4	20 92
3690	Louis D. Hall	do	4	15 33
3691	T. E. Orr	do	4	90 12
3692	Gertrude C. Sober	Instructor Domestic Science	7	13 56
3693	C. G. Hopkins	Instructor State Institute	4	19 03
3694	T. L. Haecker	do	4	57 00
3695	A. C. Beal	do	4	12 50
3696	H. A. Aldrich	Expenses as director	4	14 56
3697	E. N. Cobb	do	4	17 30
3698	O. T. Bright	Expenses instructor State Inst	4	33 90
3699	M. K. Sweet	Expenses as director	4	8 68
3700	James Frake	do	4	7 70
3701	H. A. McKeene	Expenses State Institute	4	13 00
3702	B. F. Wyman	Expenses as director	4	29 01
3703	Ralph Allen	do	4	11 50
3704	H. G. Easterly	do	4	25 65
3705	A. B. Hostetter	Expenses as secretary	4	14 75
3706	H. A. Aldrich	Expenses as director	4	23 17
3707	Hotel Munroe	Board for speakers State Inst	4	4 50
3708	E. L. Wilson	Cuts, programs, etc., State Inst	4	2 75
3709	H. A. McKeene	Salary as clerk for February	2	83 33
3710	John Underfanger	Drayage	1	35
3711	A. B. Hostetter	Fee in A. L. association	3	2 00
3712	Orange Judd Company	8 vol. library books	3	5 89
3713	John P. Winsor	Treasurer Grundy county inst	5	75 00
3714	O. B. Whitmore	Treasurer Lake county inst	5	75 00
3715	O. B. Whitmore	Treasurer 10th cong district inst	6	50 00
3716	J. H. Smith	Treasurer Henry county inst	5	75 00
3717	J. H. Smith	Treasurer 15th cong. district	6	50 00
3718	John R Belsley	Expenses as delegate D. con	4	3 00
3719	W. C. Slemmons	Treasurer Edgar county inst	5	49 65

Approved March 4, 1905.

3720	American Express Co	Expressage	1	$ 15 89
3721	Pacific Express Co	do	1	8 47
3722	United States Express Co	do	1	12 51
3723	Coe Bros	Neostyle supplies	1	5 90
3724	H. W. Rokker	Printing programs	1	74 50
3725	Frank H. Hall	Salary as superintendent	2	214 28
3726	A. C. McClurg & Co	111 library books	3	104 94
3727	Frank Simmons	Library books	3	2 95
3728	J. W. Diller	do	3	1 75
3729	C. F. Curtis	Instructor State Institute	4	25 00
3730	Albert N Hume	do	4	17 20
3731	L. H. Kerrick	do	4	8 49
3732	Herbert W. Mumford	do	4	11 58
3733	A. N. Abbott	Expenses as director	4	16 31
3734	Geo. W. Dean	do	4	20 25
3735	Edw. Grimes	do	4	18 55
3736	Joseph Newman	do	4	8 50
3737	E. E. Chester	do	4	35 33
3738	Frank H. Hall	Expenses as superintendent	4	47 67
3739	David Felmley	Instructor State Institute	7	4 60
3740	Mrs. S. Noble King	Expenses Domestic Science ass'n	7	2 50
3741	Schnepp & Lauer	Binding bulletins	3	19 50
3742	Z. R Genung, treas	Treasurer Champaign county inst	5	14 30
3743	A. W. Davis	Treasurer Kane county inst	5	75 00
3744	A. W. Davis	Treasurer 11th cong. inst	6	50 00
3745	Wm. M. Grisson, Jr	Johnson county inst	5	20 50

Approved March 6, 1905.

Summary.

Balance on hand—

Fund No. 1	$ 753 83
2	1,077 25
3	2,006 12
4	489 12
5	....
6	279 96
7	382 09
8	....

The amounts to the credit of each fund in the books of the auditor and secretary show the same as the treasurer's balance less the outstanding warrants drawn on each fund as follows:

Warrant number.	Fund 1.	Warrant number.	Fund 2.	Warrant number.	Fund 3.	Warrant number.	Fund 4.	Warrant number.	Fund 6.	Warrant number.	Fund 7.
3664..	$19 25	3709..	$83 33	3072..	$1 00	1749..	$ 1 00	3715..	$50 00	3681	$94 00
3710..	35			3711..	2 00	2706..	1 00	3717..	50 00	3684	32 25
				3712..	5 89	2729..	2 98			3685	15 00
						3641..	16 26			3686	9 60
						3694..	57 00			3692	13 56
						3696..	14 56				
						3697..	17 30				
						3699..	8 68				
						3702..	29 01				
						3704..	25 65				
						3706..	23 17				
						3708..	2 75				
						3718..	3 00				
	$19 60		$83 33		$8 89		$202 36		$100 00		$164 41

SUMMARY.

	Treasurer's balance.	Outstanding orders.	Secretary's balance.	Auditor's balance.
Fund 1	$ 753 83	$ 19 60	$ 734 23	$ 734 23
Fund 2	1,077 25	83 33	993 92	993 92
Fund 3	2,006 12	8 89	1,997 23	1,997 23
Fund 4	489 12	202 36	286 76	286 76
Fund 6	279 96	100 00	179 96	179 96
Fund 7	382 09	164 41	217 68	217 68
			$4,409 78	$4,409 78

Respectfully submitted,

MERRILL K. SWEET,
EDWARD GRIMES,
EUCLID N. COBB,
G. W. DEAN,
B. F. WYMAN,
Finance Committee.

Adopted March 7, 1905.

Superintendent Hall submitted the following report:

To the Board of Directors of the Illinois Farmers' Institute:

Your by-laws make it my duty as Superintendents of Institutes, (1) to report at this meeting concerning the institute work for the past and (2) to make such recommendations as seem to me desirable concerning the work of the ensuing year.

My report at the annual Round-up is now in print and I beg to refer you to that as covering in the main both a retrospective and a prospective view of the institute field from the standpoint of the superintendent. With your permission, however, I desire to reproduce certain parts of the report referred to, particularly those relating to the next years operations and to give some additional reasons for the recommendations already made.

Your superintendent recommends:

1. That the director's approval should be made necessary in the fixing of the dates for the institutes of his district.
2. That the director should have power to select all speakers that come from outside the county in which an institute is to be held. (In practice, this would be done after consultation with the county institute officers and their wishes would, as far as practicable, be taken into the account in the selection of such speakers.)
3. That no program for an institute should be printed at the expense of the state that does not bear upon its face the approval of the director; and this approval should be a necessary condition to the payment from the treasury of any bills incurred.

There is no disposition on the part of the superintendrnt unduly to magnify the importance of some centralization of authority; but unless directors can direct in some general way, a high degree of efficiency, and economic expenditure of the money appropriated, are impossible.

With experienced men as officers of the county organization and with harmony between those officers on the one hand, and the district director on the other, the present system gives excellent results. Generally speaking. the counties have such officers, and harmony prevails, and the institutes are a credit to the organization and to the state. The change suggested would not make the work less efficient or less harmonious in any district, while it would greatly strengthen it in counties that elect inexperienced officers and in districts in which ambitious leaders antagonize or ignore the district director.

Moreover, a movement is on foot to give us help from the Department of Agriculture at Washington. It is quite probable that some help of this kind will be available during the ensuing year. Such assistance has already been given to some states—notably, Missouri and Pennsylvania.

We are not in a position to avail ourselves of such assistance, and can not be until circuits can be established at the district conferences that will not be inceremoniously turned down by county officers.

If, for instance, the Chief of the Bureau of Plant Industry, through the institute specialist, the Hon. John Hamilton, offers your superintendent a man for one month, your superintendent working through the district directors, should be able to make an itinerary for the speaker that would give us the largest possible amount of his time with the least possible expenditure for traveling. If the superintendent must make out such itinerary by conferring with the officers of each county (1) as to their wishes, and (2) as to the dates when the speaker can be given an audience, if county officers can change their dates and strike out the names of speakers without consultation with the director, then the attempt to avail ourselves of such outside help, will be abortive. Moreover, speakers from the Department of Agriculture, if sent at all, will be sent to states that can use tnem to the best advantage.

What I have said with reference to speakers from Washington applies with nearly the same force to speakers from our own college and station.

Economy in the employment of such speakers as go long distances to make their appointments, demands some centralization of authority.

It is through organization that results are obtained, and the plan suggested seems to the superintendent a necessary part of the institute machinery. The director is elected by delegates from the several counties in the district. He is the choice of a majority of the county institute officers. He is supposed to be a man of good judgment and some experience in institute management. He should be allowed to do the work for which he is selected, namely, to direct in the institute management.

Director Rossiter moved the acceptance of the report and that the recommendations be made a part of our records.

Motion adopted.

Director Allen, chairman of Committee on Soils stated that the report of the committee was not yet ready.

Director Frake moved that Chairman Allen be authorized to forward report to the secretary when finished.

Motion adopted.

Director Frake moved that Director Davenport be appointed a committee of one to draft a resolution setting forth the work accomplished by the institute the past year.

Motion adopted.

On motion the board took thirty minutes recess.

Director Frake moved the appointment of a Committee on Credentials whose duty it should be to report to the board as to members elect from the even numbered districts. and as to whom were entitled to seats as *ex-officio* members of the board of directors.

Motion adopted.

The president appointed Directors Newman, Frake and J. P. Mason.

The Committee on Credentials reported as follows:

To the Board of Directors of the Illinois Farmers' Institute:

We, your Committee on Credentials, beg leave to report that the following named persons were elected directors from their respective districts for the ensuing term: Second district, B. R. Pierce, Chicago; Fourth district, W. Malcom Manley, Chicago; Sixth district, F. C. Rossiter. Chicago; Eighth district, John M. Clark, Chicago; Tenth district, Ralph W. Chittenden, Gurnee; Twelfth district, B. F. Wyman, Sycamore; Fourteenth district, Wm. H. Lyford, Port Byron; Sixteenth district, Ralph Allen, Delavan; Eighteenth district, F. I. Mann, Gilman; Twentieth district, A. P. Grout, Winchester; Twenty-second district, E. W. Burroughs, Edwardsville; Twenty-fourth district, J. F. McCartney, Metropolis. *Ex-officio*—H. A. Aldrich, president Illinois Horticultural Society; Joseph Newman president Illinois Dairymen's Association; A. D. Barber, president State Board of Agriculture; Alfred Bayliss, Superintendent of Public Instruction; Eugene Davenport, dean of the college agriculture, University of Illinois.

Director Easterly moved the adoption of the report.

Motion adopted.

Director Allen moved that the board proceed to the election of officers for the ensuing year.

Motion adopted.

Director Newman moved that the president appoint three tellers.

Motion adopted.

The president appointed Directors Newman, Easterly and Burroughs.

Director J. P. Mason moved that an informall ballot be taken for president for the ensuing year.

Motion adopted.

On informal ballot there were 19 votes cast as follows: Wyman, 12; Burroughs, 4; Grimes, 1; Mason, S. B., 1; Frake, 1.

Director Rossiter moved that a formal ballot be taken for president.

Motion adopted.

The formal ballot resulted as follows: Twenty votes were cast: Wyman, 16; Burroughs, 4.

On motion of Director Burroughs, the election of Director Wyman as president for the ensuing term was made unanimous.

Mr. J. P. Mason moved that an informal ballot be cast for vice-president for the ensuing term.

Motion adopted.

The informal ballot resulted as follows: Twenty-two votes cast: Burroughs, 14; Allen, 2; Lyford, 1; Newman, 1; Abbott, 1; Mann, 3.

Director Newman moved that the informal ballot be made formal.

The motion was adopted and Director Burroughs was declared duly elected vice-president for the ensuing term.

Director Newman moved that the secretary *pro tem.* be instructed to cast the ballot of the entire board of directors for Dr. Frank H. Hall for superintendent of institutes.

The motion carried and the secretary *pro tem.* cast the ballot as instructed and Mr. Hall was declared elected superintendent of institutes for the ensuing year.

The ballot for treasurer resulted in the unanimous election of Director Grout.

An informal ballot was cast for secretary of the board for the ensuing year. Dr. Frank H. Hall received all of the 22 votes cast.

On motion of Director Burroughs, the informal ballot was made formal and Dr. Hall was declared elected secretary for the ensuing term.

On motion the secretary *pro tem.* was instructed to cast the ballot of the entire board of directors for F. I. Mann as auditor of the board for the ensuing term.

The ballot was cast as per instructions and Director Mann was declared duly elected auditor of the board for the ensuing term.

Director Bayliss moved that a committee be appointed to make recommendations to the board as to the amount to be allowed for clerk hire and as to any changes necessary to be made in the by-laws.

Motion adopted.

The president appointed Directors Grout, Bayliss and Davenport to act as such committee.

Director Rossiter moved that Mr. John M. Houseman, of 938 St. Louis avenue, Chicago, be elected a director from the Fifth Congressional district to fill existing vacancy in said district.

Motion adopted.

Director Davenport, Committee on Resolutions, reported the following and moved its adoption:

WHEREAS, The year that has passed is one of the most successful in the history of the Illinois Farmers' Inititute, therefore, be it

Resolved, that in the opinion of this board a large measure of this success is due to the wise administration of President Wyman and the untiring labors of Superintendent Hall, and

WHEREAS, A wise Providence has removed the son of our honored president at the age of full maturity and as he was but just entering upon the responsibilities of a life full of promise, therefore be it

Resolved, that this board tenders to President Wyman our heartfelt sympathy in this great grief that has befallen him and his family.

Resolution adopted.

Mr. Tippitt of Olney presented the following invitation from the Citizens' Improvement Association of Olney, Illinois:

OLNEY, ILL., March 6, 1905.

To the Board of Directors of the Illinois Farmers' Institute, Springfield, Illinois:

GENTLEMEN—The Citizens' Improvement Association of the city of Olney extend to your association a most cordial invitation to hold your next annual convention in this city.

Olney, as the county seat of Richland county and the principal city in "Egypt," is in the center of the agricultural, fruit and poultry producing region of southern Illinois, and with her splendid railroad facilities, hotel accommodations, public buildings and many municipal improvements, offers you an ideal place for your institute.

Our people, hospitable by nature, will leave nothing undone to make your brief visit one of the most profitable events of your life, if you decide to visit them in 1906. We are authorized to extend to you the free use of the opera house, with a seating capacity of 1,000, as per enclosed letter of the manager.

Again extending to you a hearty welcome, we are,

Most respectfully yours,

(Signed) WM. BOWER,
President.

E. M. ROWLAND,
Secretary.

Mr. Wm. Bower, President Citizens' Improvement Association, Olney, Illinois:

DEAR SIR—I am authorized by Mr. J. F. Hyatt to tender you the free use of Hyatt's Opera House to be offered for the State meeting of the Illinois Farmers' Institute to be held in February, 1906.

ERNEST BOWER,
Manager.

Mr. Tippitt spoke at length for the citizens of Olney. Directors Frake and Schermerhorn and Senator Houser also spoke on the subject.

Director McCartney moved that it was the sense of this board to accept the invitation extended by the citizens of Olney.

Director Newman moved to amend the motion of Mr. McCartney by instructing the Executive Committee to visit Olney and investigate the halls and other accomodations offered, said committee to have power to accept or reject the invitation as in their judgment was to the best interest of the institute.

Director McCartney accepted the amendment and the motion was adopted.

Director Abbott moved that the matter of the press bureau be left to the Executive Committee with power to act.

Motion adopted.

On motion the board adjourned to 9:00 o'clock a. m., Wednesday.

WEDNESDAY, 9:00 O'CLOCK A. M.

The board met pursuant to adjournment, President Wyman in the chair, and the following named directors present:

Directors Aldrich, Abbott, Allen, Bayliss, Burroughs, Chittenden, Chester, Davenport, Grimes, Grout, Lyford, Mann, Mason, J. P., Mason, S. B., Newman, Sweet and Wyman.

Director Sweet, of the Finance Committee, reported as follows:

We, your Finance Committee, beg leave to report that we recommend the transfer of funds as follows:

That $200.00 be transferred from fund No. 1 to fund No. 4.
That $300.00 be transferred from fund No. 2 to fund No. 4.
That $129.96 be transferred from fund No. 6 to fund No. 4.

Respectfully submitted,
(Signed) MERRILL K. SWEET,
EDWARD GRIMES,
E. N. COBB,
G. W. DEAN,
B. F. WYMAN,
Committee.

On motion of Mr. Sweet, the report was adopted.

The superintendent offered for the consideration of the board the following resolution:

WHEREAS, The Illinois Farmers' Institute, in convention assembled, at the annual round-up in Joliet, approved what is known as the "Grout Corn Judging Contest," and earnestly recommended that similar contests be provided in as many counties as possible, and

WHEREAS, Such contests involve two weeks of instruction in corn judging at the agricultural college, this being given as a premium for skill exhibited by the contestants, and

WHEREAS, The dean of the college of agriculture has expressed to the superintendent and to others his hearty approval and his earnest desire for the general adoption of the Grout plan; therefore, be it

Resolved, That the dean be, and is hereby, requested to prepare for publication in the Farmers' Institute Bulletin VII, an announcement setting forth the fact that such instruction will be provided at the college of agriculture for a period of two weeks during the months of January or February of each year.

Director Newman moved that the board approve the resolution and re-affirm the action of the former meeting.

Motion adopted.

Director Grout moved that the salary of the superintendent and secretary be $2,000.00 a year, as provided by the present statute for secretary, and that Mr. Hall's duties as superintendent and secretary begin on the 8th day of March, 1905, and that the arrangement heretofore existing between the board and Dr. Hall as to salary as superintendent, cease with the adoption of this motion.

Motion adopted.

Director J. P. Mason moved that the secretary *pro tem* be instructed to cast the ballot of the entire board for Frank H. Hall for secretary to serve the unexpired term.

Motion adopted.

The secretary *pro tem* cast the ballot as instructed, and Dr. Hall was declared elected secretary to serve the unexpired term.

Superintendent Hall made the following remarks and suggestions:

MR. PRESIDENT AND GENTLEMEN—At your meeting Mar. 7, 1905, by unanimous vote, you re-elected me Superintendent of Institutes and elected me secretary of your board. I thank you most heartily for this emphatic approval of my work as superintendent during the last two years. I can not find words to express my appreciation of your candid support of every measure I have proposed for the betterment of the institute work and by your invaluable counsel and suggestions both as individuals and as a board. You can not fail to understand, however, that you have by your action yesterday increased my labors and diminished my monthly salary.

During the year 1904-05 I was employed by you for seven months at $214.28 a month. Under the new plan I will be expected to be on duty twelve months each year instead of seven, at a salary fixed by law at $166.66 a month.

I can not accept the double headed proposition offered me, with its increased burdens and great honor without the express understanding—

(1) That the clerical work of this office is to be performed by an assistant secretary nominated by myself and acting under my direction, and paid a salary to be determined by your action, out of money available for this purpose.

(2) That the traveling expenses of the superintendent and secretary and of the assistant secretary, when such expenses are necessarily incurred in the performance of official duties, are to be paid by the board out of moneys appropriated for this purpose.

(3) That the superintendent and secretary is to be allowed to do such work in teachers' institutes and other meetings of teachers as he been accustomed to do in the spring and summer months, or at any time when this can be done without neglect of his duties as an employé of this board, and to accept pay therefore from those seeking his services and giving him employment.

If, under these conditions, the board of directors of the Illinois Farmers' Institute, re-affirms its action of March 7th, herein referred to, I will cheerfully undertake to perform the duties of secretary and superintendent.

Director Davenport moved the adoption of Dr. Hall's suggestions and also that the board re-affirm the action of the board in the election of Dr. Hall as superintendent and secretary.

Motion adopted.

Director Grout, chairman, of committee on by-laws, reported as follows and moved the adoption of the report:

GENTLEMEN—Your committee appointed to recommend an additional section to the by-laws, beg leave to report as follows:

The secretary may nominate an assistant secretary, to be approved by the board, and authorize him to perform any duty devolving upon the secretary and for whose acts the secretary shall be responsible.

We recommend that the salary of the assistant secretary be fixed at $1,500.00 a year.

(Signed) A. P. GROUT
E. DAVENPORT,
Committee.

Motion adopted.

Director Allen moved that the secretary be authorized to draw warrant in payment of the expense of printing library catalog.

Motion adopted.

Director Newman moved that the secretary be authorized to contract for the use of the telephone most suited to the purposes of the office.

Motion adopted.

Director Burroughs, chairman of the Domestic Science committee, made the following report:

MR. PRESIDENT AND GENTLEMEN—The work of the Illinois Association of Domestic Science the past year shows a growing interest in the study of subjects that are of great importance in maintaining healthful. happy homes and we have reason to think that the coming year will mark still greater advance because many societies are taking up a course of study for that special subject. There is a concerted action in many counties which indicate a desire for scientific knowledge of household matters. There is especial need of a well trained woman who can give her time to the instruction of women and girls at the institutes. It is needless to say that a knowledge of scientific farming ought to be supplimented by a knowledge of scientific housekeeping if we are to have the ideal home that we all hope to see in the near future. We are reliably informed that Illinois is the only State that has the work for women organized. The records show that the funds apportioned to the association have been wisely expended and we therefore recommend that this board appropriate $500.00 as usual, for the expenses of the association the ensuing year.

We also recommend that in the event of the organization of a correspondence school in connection with the college of agriculture, the association of domestic science be properly recognized in connection therewith.

In the matter of scientific instructors for institute work, we recommend that this board in making assignments for such work, the Illinois Association of Domestic Science be represented by a woman well qualified to instruct along lines in keeping with the objects of the organization.

Respectfully submitted,

[Signed.]
E. W. Burroughs.
S. B. Mason.
B. F. Wyman.
Committee.

On motion of Director Newman the report was adopted.

Director Allen offered the following resolution and moved its adoption:

Resolved, That the director of each district consisting of more than two counties shall not less than thirty days previous to the date of holding their institutes of a circuit of counties, call a conference of each circuit of his district at some convenient point, consisting of one person selected by each county for the purpose of arranging and completing the progress of institutes in the circuit of institutes. All necessary expenses of one delegate from each county while in attendance at such conference to be paid by the Illinois Farmers' Institute, upon itemized bills approved by the director of said district.

Resolution adopted.

Director Allen moved that the meeting that we have heretofore called the "Annual Round-up Meeting" be hereafter called the "Illinois Farmers' State Institute Meeting."

Motion adopted.

Director Allen moved that the superintendent of institutes be instructed to confer with Professor James of the university of Illinois, with a view to securing the services of Prof. Ira Baker as an institute speaker on the "Road Question," at institutes.

Motion adopted.

Superintendent Hall nominated H. A. McKeene for assistant secretary.

Director Grout moved that the board approve the nomination.

Motion adopted.

On motion the board adjourned.

COUNTY INSTITUTE REPORTS.

COUNTY.	Institute held at—	Date of meetings.	Largest attendance	Next largest.	Total cost.
Adams	Camp Point	Oct. 14,15,1904	300	150	$ 92 08
Alexander	Olive Branch	Nov. 18,19,1904	300	150	66 60
Bond	Greenville	Nov. 11,12,1904	200	150	23 33
Boone	Belvidere	Jan. 18,19,20,1905	500	500	125 30
Brown	Mt. Sterling	Nov. 22,23,1904	275	235	66 62
Bureau	Buda	Jan. 27,28,1905	500	400	137 83
Calhoun	Hardin	Dec. 1,2,3,1904	100	50	129 41
Carroll	Thompson	Dec. 15,16,1904	175	150	106 24
Cass	Ashland	Oct. 19,20,21,1904	50	40	125 76
Champaign	Sadorus	Oct. 12,13,1904	1,290	1,000	76 70
Champaign	Urbana	Feb. 14,15,1905	250	150	51 25
Christian	Assumption	Dec. 14,15,16,1904	840	630	159 00
Clark	Marshall	Dec. 15,16,1904	100	80	75 00
Clay	Clay City	Dec. 6,7,8,9,1904	700	500	110 18
Clinton	Germantown	Dec. 6,7,1904	100	60	74 87
Coles	Mattoon	Oct. 11,12,13,1904	150	100	95 95
Cook	Arlington Heights	Dec. 9,10,1904	360	165	105 56
Crawford	Robinson	Dec. 1,2,3,1904	250	200	74 20
Cumberland	Toledo	Oct. 12,13,14,1904	500	300	104 58
DeKalb	Somanauk	Dec. 27,28,29,1904	200	150	147 25
DeWitt	Clinton	Jan. 12,13,14,1905	800	700	105 97
Douglas	Arcola	Oct. 13,14,15,1904	70	50	74 57
DuPage	Wheaton	Jan. 16,17,18,1905	500	400	300 00
Edgar	Paris	Mar. 1,2,1905	200	150	49 65
Edwards	Browns	Oct. 18,19,20,1904	200	100	69 29
Effingham	Effingham	Dec. 6,7,8,1904	400	160	68 68
Fayette	Vandalia	Nov. 9,10,11,1904	1,500	500	110 74
Ford	Paxton	Jan. 2,3,4,1905	150	150	75 00
Franklin	Benton	Oct. 28,29,1904	300	200	75 00
Fulton	Lewistown	Jan. 25,26,27,1905	450	400	137 86
Gallatin	Omaha	Nov 16,17,1904	100	75	75 00
Greene	White Hall	Nov. 16,17,1904	210	180	135 65
Grundy	Morris	Feb. 8,9,1905	250	200	91 21
Hamilton	McLeansboro	Nov. 30-Dec. 1,2,1904	1,200	1,000	104 58
Hancock	Plymouth	Oct. 13,14,1904	100	50	55 23
Hancock	Bowen	Feb. 9,10,1905	100	80	31 87
Hardin	Elizabethtown	Nov. 17,18,1904	75	50	57 00
Henderson	Stronghurst	Nov. 17,18,19,1904	300	180	96 82
Henry	Orion	Jan. 24,25,26,1905	400	300	157 44
Iroquois	Watseka	Feb. 7,8,1905	250	200	158 11
Jackson	Murphysboro	Dec. 1,2,3,1904	225	175	64 36
Jasper	Newton	Dec. 13,14,15,1904	500	500	127 00
Jefferson	Mt. Vernon	Nov. 29,30,1904	500	400	76 40
Jersey	Jerseyville	Nov. 15,16,1904	250	150	71 50
JoDaviess	Apple River	Dec. 16,17,1904	500	400	75 00
Johnson	Vienna	Oct. 24,25,26,1904	800	600	144 00
Kane	Geneva	Feb. 15,16,17,1905	700	600	211 97
Kankakee	Kankakee	Feb. 16,17,1905	150	140	76 37
Kendall	Plano	Jan. 17,18,1905	800	600	138 09
Knox	Abingdon	Jan. 27,28,1905	500	350	75 00
Lake	Grays Lake	Jan. 31,1905	400	300	131 15
Lake	Waukegan	Feb. 1,2,3,1905	400	300	
LaSalle	Ottawa	Feb. 7,8,1905	600	400	229 30
Lawrence	Lawrenceville	Oct. 19,20,21,1904	6,000	5,000	61 25
Lee	Ashton	Dec. 20,21,22,1904	500	350	101 05
Livingston	Fairbury	Jan. 4,5,6,1905	306	250	91 29
Logan	Lincoln	Dec. 6,7,8,1904	500	400	81 40
Macon	Decatur	Jan. 10,11,12,1905	1,000	800	189 75
Macoupin	Carlinville	Nov. 22,23,1904	1,200	1,200	181 85
Madison	Troy	Nov. 16,17,1904	1,450	1,000	104 81
Marion	Salem	Dec. 7,8,9,1904	1,000	500	85 00
Marshall	Lacon	Feb. 2,3,1905	275	175	51 05
Mason	Havana	Oct. 18,19,20,1904	600	500	82 42
Massac	Metropolis	Oct. 27,28,29,1904	700	500	75 00
McDonough	Macomb	Dec. 7,8,1904	250	200	75 00
McHenry	Report delayed	....	....	....	....
McLean	Bloomington	Dec. 7,8,9,1904	700	500	167 00
Menard	Petersburg	Nov. 18,19,1904	300	200	75 00
Mercer	Seaton	Nov. 15,16,1904	50	25	72 23
Monroe	Waterloo	Nov. 14,15,1904	900	100	73 71
Montgomery	Nokomis	Nov. 15,16,17,1904	700	650	137 27
Morgan	Franklin	Oct. 19,20,21,1904	300	250	64 30
Moultrie	Bethany	Feb. 9,10,1905	500	425	75 04
Ogle	Rochelle	Jan. 10,11,12,1905	450	400	149 94
Peoria	Dunlap	Jan. 24,25,1905	140	85	68 58
Perry	Cutler	Noy. 30-Dec. 1,1904	300	300	105 20
Piatt	Cerro Gordo	Jan. 10,11,1905	500	400	87 12

County Institute Reports—Concluded.

COUNTY.	Institute held at—	Date of meetings.	Largest attendance	Next largest.	Total cost.
Pike	Pittsfield	Oct. 20,21,22,1905	60	40	$ 85 10
Pope	Golconda	Oct. 26,27,1904	74	65	37 38
Pope	Brownfield	Jan. 12,13,1905	60	40	19 09
Pulaski	Mound City	Nov. 16,17,1904	125	105	66 67
Putnam	Hennepin	Feb. 9,10,1905	240	100	74 68
Randolph	Sparta	Nov. 29,30,1904	400	200	75 00
Richland	Olney	Nov.30-Dec.1,2,1904	700	500	109 85
Rock Island	Edgington	Dec. 6,7,1904	300	200	75 00
Saline	Harrisburg	Nov. 15,16,1904	175	185	75 00
Sangamon	Auburn	Dec. 6,7,8,1904	100	50	75 00
Schuyler	Report delayed	....	....	....	....
Scott	Winchester	Nov. 17,18,1904	300	100	79 31
Shelby	Shelbyville	Feb. 15,16,17,1905	120	100	108 38
Stark	Castleton	Jan. 25,26,1905	175	75	58 06
St. Clair	New Athens	Nov. 15,16,1904	200	150	127 10
Stephenson	Freeport	Jan. 12,13,1905	1,000	800	123 28
Tazewell	Mackinaw	Oct. 5,6,7,1904	1,000	860	174 67
Union	Anna	Nov. 15,16,1904	550	400	59 72
Vermilion	Hoopeston	Jan. 11,12,1905	190	175	45 85
Wabash	Mt. Carmel	Nov. 14,15,16,1904	400	150	83 97
Warren	Kirkwood	Nov. 16,17,1904	750	45	56 67
Washington	Nashville	Nov. 21,22,23,1904	750	400	114 73
White	Carmi	Dec. 1,2,3,1904	41	32	63 40
Wayne	Fairfield	Oct. 17,18,19,1904	....	....	57 66
Whiteside	Rock Falls	Dec. 13,14,1904	265	150	141 97
Will	Joliet	Jan. 19,20,1905	1,800	1,600	115 66
Williamson	Marion	Oct. 27,28,1905	300	50	54 30
Winnebago	Rockford	Jan. 10,11,12,1905	1,000	800	259 22
Woodford	El Paso	Jan. 5,6,1905	600	450	155 25

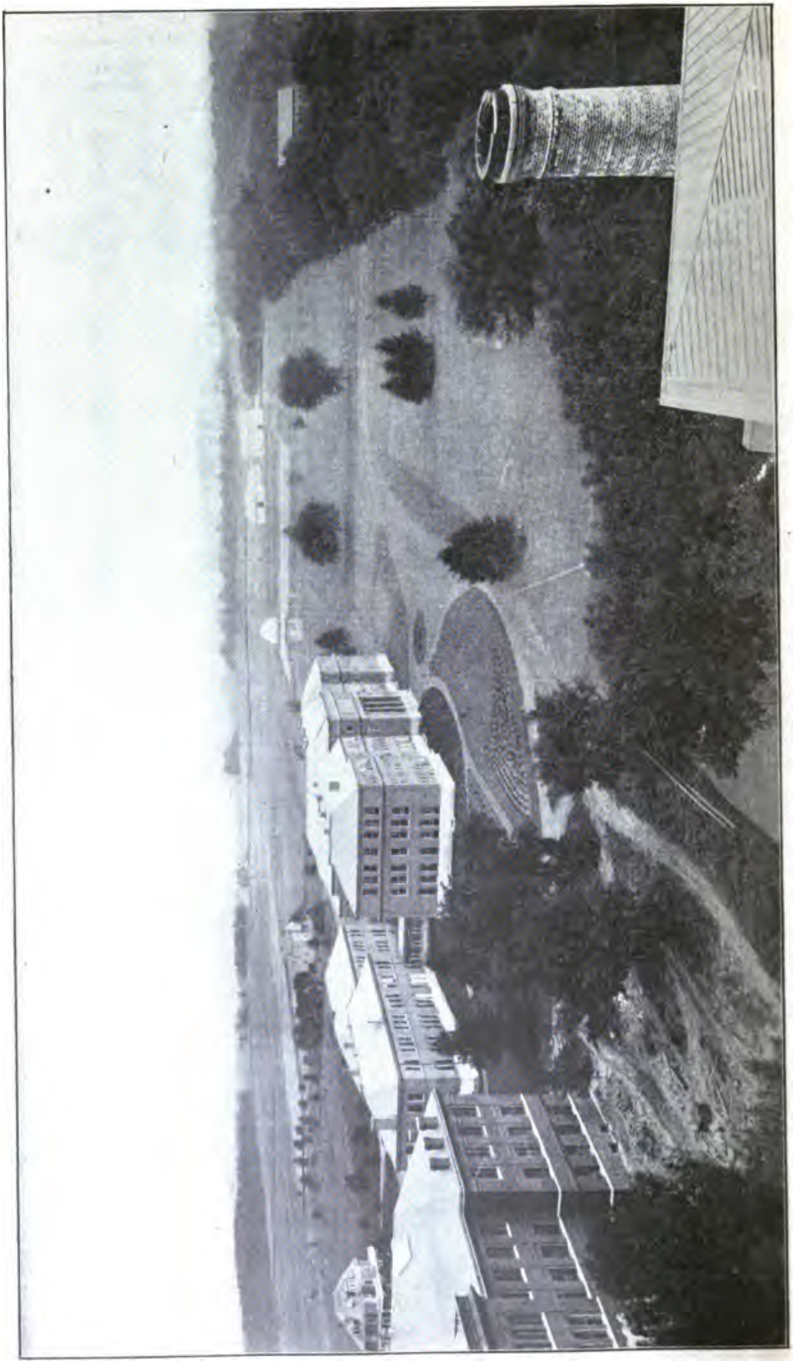
SUMMARY.

Number of counties reported	100	
Number of days on which institutes were held	249	
Total number of sessions	623	
Total attendance	69,759	
Total cost of institutes	....	$9,963 72
Of this the State paid	....	6,797 51
Contributors, county boards, etc	....	3,166 21
Four counties held two institutes of two days each, viz: Champaign, Hancock, Lake and Pope.		
Report of McHenry and Schuyler counties are delayed.		

SCHOLARSHIPS IN THE COLLEGE OF AGRICULTURE.

One hundred thirty-three recommendations for such scholarships for the two years beginning September, 1904, were made by the directors of this board.

On December 7th Mr. W. L. Pillsbury, Registrar of the University of Illinois, reported that our list was full, one hundred ten scholarships being accepted. He also stated that four congressional districts of Cook county and thirty-seven counties had no students of their own, but that the places had been filled from other territory. There were at this same date, nine students at the College of Agriculture who secured scholarships for the year 1901-2; fourteen for 1902-3; forty-seven for 1903-4 and 110 for 1904-5. Total, 180.



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